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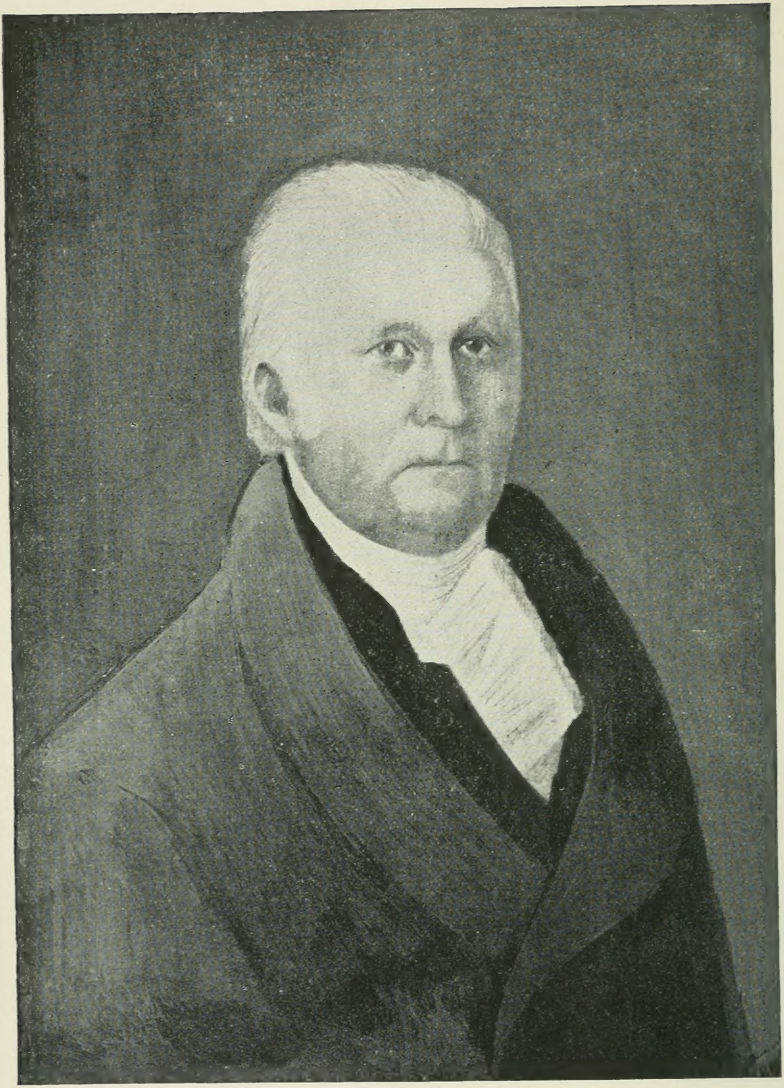

THOMAS RIDOUT,

Surveyor General of Upper Canada in 1810.

PROCEEDINGS

OF THE

ASSOCIATION OF

ONTARIO LAND SURVEYORS

AT ITS FIRST ANNUAL MEETING, SINCE INCORPORATION,

HELD AT TORONTO, ON FEBRUARY 28TH,
MARCH 1ST AND 2ND,

1893

Being the Eighth Annual Meeting of the Association of Provincial Land Surveyors of Ontario

---

AFFILIATED WITH ASSOCIATION OF DOMINION LAND SURVEYORS
AND ASSOCIATION OF PROVINCIAL LAND SURVEYORS
OF BRITISH COLUMBIA.

The Second Annual Meeting (Ninth Annual Meeting of the Association of Provincial Land Surveyors of Ontario) will be held in Toronto, on Tuesday, 27th of February, 1894.

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PRINTED FOR THE ASSOCIATION
BY
C. BLACKETT ROBINSON, 5 JORDAN STREET,
TORONTO.

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1895

PATRONIZE OUR ADVERTISERS.

NOTICES.

The attention of the members is called to the list of Standing Committees as given on page 6. Each member should assist the Standing Committees as much as possible.

Members can be supplied with copies of the Proceedings for 1887, 1888, 1889, 1890, 1891, or 1892 by remitting fifty cents to the Secretary.

Copies of the Ontario Land Surveyors' Act, and By-Laws of the Association will be sent upon receipt of three-cent stamp.

PATRONIZE OUR ADVERTISERS.

PREFACE.

To the Members of the Association of Ontario Land Surveyors:

The Proceedings of the Association at its first Annual Meeting since incorporation, are herewith presented.

Appended will be found the By-Laws of the Association, and Regulations of the Board of Examiners.

The attendance at this meeting was larger than at any previous one, and much interest was manifested in the discussions.

Affiliation with The Association of Dominion Land Surveyors, and The Association of Provincial Land Surveyors of British Columbia has been accomplished, and it is hoped that much benefit may result from the union of interests of representatives of our profession in the various parts of the Dominion.

The result of the Election of Officers leaves the *personnel* of the Council of Management the same as that of last year.

Each member is requested to exert himself personally to forward the interests of the Association in any direction within his power, and it is particularly desired, that the matter of contribution to the programme for our next Annual Meeting, be kept in view during the year.

Respectfully submitted on behalf of the Council.

A. J. VanNOSTRAND,
Secretary.

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ASSOCIATION OF

ONTARIO LAND SURVEYORS

[INCORPORATED 1892].

ORGANIZED 23RD FEBRUARY, 1886.

Officers for 1893-94.

PRESIDENT.

Elihu Stewart, O.L.S., Collingwood.

VICE-PRESIDENT.

M. J. Butler, O.L.S., Napanee.

SECRETARY-TREASURER.

A. J. VanNostrand, O.L.S., Toronto.

COUNCILLORS.

Hon. A. S. Hardy, Commissioner of Crown Lands.

G. B. Kirkpatrick, O.L.S., Toronto	For 3 years.
A. Niven, O.L.S., Haliburton	
P. S. Gibson, Willowdale	For 2 years.
M. Gaviller, Barrie	
J. McAree, Toronto	For 1 year.
V. Sankey, Toronto	

AUDITORS.

Willis Chipman, C.E., Toronto.
H. Proudfoot, C.E., Toronto.

BANKERS.

Imperial Bank of Canada.

BOARD OF EXAMINERS.

V. Sankey, Toronto (Chairman).

M. J. Butler, Napanee
G. B. Kirkpatrick, Toronto } Appointed by Lieut.-Gov. in Council.

P. S. Gibson, Willowdale
A. Niven, Haliburton
R. Coad, Glencoe
M. Gaviller, Barrie } Appointed by Council.

STANDING COMMITTEES.

Land Surveying.—M. Gaviller (Chairman), H. J. Browne, T. B. Speight, J. M. Tiernan, L. V. Rorke, J. L. Morris, B. J. Saunders.

Drainage.—H. J. Bowman (Chairman), J. C. MacNabb, R. Coad, R McDowall, H. Winter, J. Robertson, W. R. Burke, Geo. Ross, C. A. Jones, A. G. Cavana, Alex. Baird, C. F. Miles.

Engineering—G. B. Abrey (Chairman), C. F. Aylsworth, Jr., O. McKay, Jno. McAree, T. H. Jones, J. W. Tyrrell, H. K. Wicksteed, A. W. Campbell.

Entertainment.—F. L. Foster (Chairman), Chas. Murphy, H. D. Ellis, T. B. Speight, A. P. Walker, H. B. Proudfoot, W. A. Browne.

Publication.—H. L. Esten (Chairman), H. J. Browne, F. L. Foster, Chas. Murphy, J. McAree, K. Gamble.

Topographical Surveying—Willis Chipman (Chairman), T. Fawcett, J. Dickson, J. P. B. Casgrain, A. L. Russell, J. Cozens, W. Ogilvie.

PROGRAMME OF THE

Association of Ontario Land Surveyors

(INCORPORATED)

AT ITS FIRST ANNUAL MEETING HELD IN TORONTO,
FEBRUARY 28TH AND MARCH 1ST AND 2ND, 1893.

PROGRAMME.

Tuesday, February 28th—Morning, 10 o'clock.

Meeting of Council.
Meeting of Standing Committees.

Afternoon, 2 o'clock.

Report of Council of Management.
Report of Secretary-Treasurer
President's Address.
Report of Committee on Land Surveying, with "Question Drawer." M. Gaviller, O.L.S., Chairman.
Report of Committee on Engineering, with "Question Drawer." G. B. Abrey, O.L.S., C.E., Chairman.
Report of Auditors.

Evening, 8 o'clock.

Paper—"Geographical Surveying," L. B. Stewart, O.L.S., D. T. S., Toronto.
Paper—"History of Taché Gold Field," H. DeQ. Sewell, O.L.S., Port Arthur.
Paper—"Timber Surveys," J. F. Whitson, O.L.S., Collingwood.

Wednesday, March 1st—Morning, 10 o'clock.

Paper—"The Duties of a Surveyor on the Maintenance-of-Way Staff of a Railroad," W. L. Innes, O.L.S., London.
Paper—"Local Improvements," P. S. Gibson, O.L.S., C.E., Willowdale.
Ratification of By-Laws.
Volunteer Papers.

Afternoon, 2 o'clock.

Paper—"A Plea for a Topographical Survey," Willis Chipman, O.L.S., C.E., Brockville.

Paper—"Shall it be a Tile Drain?" H. J. Bowman, O.L.S., C. E., Berlin.

Paper—"The Mexican Amalgamation Progress," Samuel Bray, O.L.S., Ottawa.

Paper—"Permanent Street Pavements," J. W. Tyrrell, O.L.S., C.E., Hamilton.

Evening, 7.45 o'clock.

Annual dinner at the Arlington Hotel.

Thursday, March 2nd—Morning, 10 o'clock.

Paper—"Draughting," F. L. Foster, O.L.S., Toronto.

Report of Committee on Drainage, with "Question Drawer." J. C. Macnabb, O.L.S., C.E., Hamilton.

Paper—"The Transit and How to use It," Cyrus Carroll, O.L.S., C.E., Hamilton.

Paper—"Drainage Difficulties in the South Western Municipalities of Ontario," Henry Winter, O.L.S., C.E., Thornyhurst.

Afternoon, 2 o'clock.

Report of Committee on Legislation, James Dickson, O.L.S., Chairman.

Report of Committee on Publication, H. L. Esten, O.L.S., Chairman.

Report of Committee on Entertainment, F. L. Foster, O.L.S., Chairman.

Unfinished Business.

Nomination of Officers.

Appointment of Scrutineers—Ballot of 1893.

New Business.

Adjournment.

ASSOCIATION OF

ONTARIO LAND SURVEYORS

(INCORPORATED).

MINUTES OF THE FIRST ANNUAL MEETING

(Eighth Annual Meeting of Provincial Land Surveyors of Ontario.)

FEBRUARY 28TH, MARCH 1ST AND 2ND, 1893.

The Association met at 2 p.m. on Tuesday, the 28th of February, in the lecture room of the Canadian Institute, 58 Richmond Street East, Toronto.

The President, Mr. Elihu Stewart, in the chair.

Moved by Lewis Bolton, seconded by M. Gaviller : That the minutes of the last meeting of the Association of Provincial Land Surveyors of Ontario, as printed in the Proceedings, be confirmed as read. Carried.

The Secretary read letters from the following gentlemen : Mr. W. E. Yarnold of Port Perry, Mr. Gibbs of Adolphustown, Mr. Henry Creswicke of Barrie, Mr. F. W. Wilkins of Norwood, and Mr. Joseph Kirk of Stratford.

After some discussion as to matters referred to in the above letters, it was moved by P. S. Gibson, seconded by A. J. VanNostrand : That the communications as read be received and laid on the table for reference. Carried.

The Secretary-Treasurer, Mr. A. J. VanNostrand, read his Annual Report.

Moved by A. Niven, seconded by H. J. Bowman : That the report of the Secretary-Treasurer be received and adopted, and that the financial statement be handed to the auditors for their report. Carried.

The President then delivered his Annual Address.

The paper prepared by Mr. Bray on "The Mexican Amalgamation Process" was read by Mr. Tyrrell, Mr. Bray being unable to attend the meeting.

Moved by A. J. VanNostrand, seconded by James Dickson: That Mr. Bray's paper be received and adopted, and that the thanks of this meeting be tendered him for it. Carried.

The Report of the Committee on Drainage was then read by Mr. Lewis Bolton, in the absence of the Chairman, Mr. J. C. Macnabb, together with some questions sent in, which matters were laid over for future discussion.

Question No. 7, submitted to the Committee on Land Surveying for 1891, was taken up and discussed (diagram explaining in Proceedings of 1891), after which it was moved by J. L. Morris, seconded by L. V. Rorke: That question No. 7 submitted to the Land Surveying Committee of 1891 be referred to the Committee on Land Surveying, with the request that they give a finding and report thereon at the next annual meeting. Carried.

On motion of Mr. Bolton, seconded by Mr. Wilkie, the meeting adjourned at 5 15 p.m.

TUESDAY EVENING SESSION, 8 O'CLOCK.

The President in the chair.

Mr. L. B. Stewart read his paper on "Geographical Surveying," after which he extended a cordial invitation to the members of the Association to pay a visit to the School of Practical Science during their stay in the city.

Moved by Mr. Kirkpatrick, seconded by Mr. Niven: That the thanks of the Association be given Mr. Stewart for the admirable paper read by him. Carried.

Mr. H. DeQ. Sewell read his paper entitled "History of Taché Gold Field."

Moved by Mr. Dickson, seconded by Mr. Miles: That a cordial vote of thanks be given Mr. Sewell for his very interesting paper. Carried.

A paper on "Timber Surveys" was then read by Mr. J. F. Whitson.

Moved by Mr. Niven, seconded by Mr. Dickson: That a vote of thanks be given Mr. Whitson for his paper. Carried.

The Report of the Council of Management was then presented by Mr. Villiers Sankey, Chairman of the Council. Mr. Sankey also referred to the case of members of the Council, who are not resident in Toronto, and who are put to considerable expense in attending the meetings other than the general annual meeting, and suggested that some steps be taken by the Association towards providing for the payment of hotel and travelling expenses of those members referred to.

On motion of Mr Sankey, seconded by Mr. Niven: The report of the Council of Management was adopted.

A discussion took place on a matter introduced by Mr. Wilkie as to a proposed new plan for the town of Almonte.

On motion of Mr. Bolton, seconded by Mr. Wilkie, the meeting adjourned at 10.30 p.m.

WEDNESDAY MORNING SESSION, 10 O'CLOCK.

The President in the chair.

The paper prepared by Mr. W. L. Innes on "The Duties of a Surveyor on the Maintenance-of-Way Staff of a Railroad," was read by the Secretary, Mr. A. J. VanNostrand, Mr. Innes not being able to attend.

Moved by Mr. Wilkie, seconded by Mr. M. J. Butler: That the thanks of the Association be tendered Mr. Innes for his paper. Carried.

Mr. P. S. Gibson then read his paper on "Local Improvements."

Moved by Mr. Gaviller, seconded by Mr. Niven: That a vote of thanks be tendered Mr Gibson for his paper. Carried.

The report of the Committee on Land Surveying was submitted by Mr. M. Gaviller, Chairman of the Committee, with Question Drawer and answers of the Committee.

After discussion, on the motion of Mr. Gaviller, seconded by Mr. Dickson, the report was received and adopted.

The meeting then adjourned, it being 1 o'clock.

WEDNESDAY AFTERNOON SESSION, 2 O'CLOCK.

The President in the chair.

Mr. Willis Chipman read his paper on "A Plea for a Topographical Survey."

Moved by Mr Kirkpatrick, seconded by Mr. Butler: That a vote of thanks be tendered Mr. Chipman for his paper. Carried

Mr. Allan Macdougall C.E., Secretary of the Canadian Institute, addressed the meeting, welcoming the members of the Association, to which the President suitably replied.

Mr. H. J. Bowman then read his paper on "Shall it be a Tile Drain?"

Moved by Mr. Tyrrell, seconded by Mr. McCulloch: That a vote of thanks be given Mr. Bowman for his paper. Carried

The ratification of by-laws was then proceeded with, Mr. Sankey, Chairman of the Committee, reading them clause by clause, each one being carried separately.

Moved by Mr. Sankey, seconded by Mr. Gibson: That the by-laws that have just been carried, clause by clause, be carried now as a whole, and that the Council be authorized to have the same printed for circulation amongst the members. Carried.

Mr. Tyrrell read his paper on "Permanent Street Pavements."

Moved by Mr. Butler, seconded by Mr. Abrey: That the paper be received and a vote of thanks given to Mr. Tyrrell. Carried.

On motion of Mr. Butler, seconded by Mr VanNostrand, the meeting adjourned at 6 o'clock.

THURSDAY MORNING SESSION, 10 O'CLOCK.

The President in the chair.

Mr. F. L. Foster read his paper on "Draughting."

Moved by Mr. Niven, seconded by Mr. Morris: That a vote of thanks be given to Mr. Foster for his paper. Carried.

"The Transit and How to use it," a paper prepared by Mr. Carroll of Hamilton, was read by Mr. Tyrrell, owing to Mr. Carroll not being able to be present at the meeting.

Moved by Mr. Niven, seconded by Mr. Tyrrell: That Mr. Carroll's paper be received and the thanks of the Association tendered him for it. Carried.

Mr. Henry Winter read his paper on "Drainage Difficulties in the South-Western Municipalities of Ontario," with a diagram on the blackboard. The discussion on this paper was laid over till the afternoon.

The discussion on the report of the Drainage Committee, which was laid over on Tuesday afternoon, was then taken up, Mr. Bolton reading the report and questions sent in.

Moved by Mr. Bolton, seconded by Mr. Niven: That the Report of the Committee on Drainage be received and adopted. Carried.

The Report of the Committee on Engineering was presented by Mr. Abrey, Chairman of the Committee.

On motion of Mr. Abrey, seconded by Mr. Bowman, the report was adopted.

Report of the Committee on Legislation was read by Mr. James Dickson, Chairman of the Committee.

Moved by Mr. Dickson, seconded by Mr. Chipman: That the report be adopted. Carried.

Mr. F. L. Foster, Chairman of the Committee on Entertainment, moved, seconded by Mr. Dickson: That the report of that committee be taken as read. Carried.

On motion of Mr. Foster, seconded by Mr. Butler, the meeting adjourned at 12 45 p. m.

THURSDAY AFTERNOON SESSION.

The President in the chair.

The Report of the Auditors was read by the President.

Moved by Mr. Sewell, seconded by Mr. McAree: That the Auditors' Report with the financial statement be received and adopted. Carried.

The Report of the Committee on Publication was read by Mr. Esten, Chairman of the Committee, and on motion of Mr. Esten, seconded by Mr. Murphy, was adopted.

The following resolution was then passed: Moved by G. B. Abrey, seconded by A. Niven: That we have to regret the death of two of the members of this Association since our last annual meeting, viz: David Suter Campbell, of Mitchell, and Isaac Lucius Bowman, of Berlin. One of these, that of Mr. Campbell, occurred before the date of publication of our last report and was mentioned as an obituary notice there. We desire to convey to the members of their respective families this expression of our sympathy and sorrow in their bereavement, and request that copies of this motion be sent to them by the Secretary.

The matter of the remuneration of the officers of the Association for services rendered being taken up, it was moved by Mr. Dickson, seconded by Mr. Tyrrell: That the Secretary-Treasurer be paid the sum of $120 for his services during the past year. Carried.

Moved by Mr. Foster, seconded by Mr. Morris: That the members of the Council of the Ontario Land Surveyors be allowed all reasonable expenses, and $6 per day while in attendance in their capacity as Councillors at all meetings, except the general annual assembly of the Association.

Moved in amendment by Mr. H. J. Bowman seconded by Mr. C. F. Miles: That the members of the Council be paid all reasonable expenses in coming to, attending and returning from Council meetings. No member, also a member of the Board of Examiners, to be paid railway fare when attending a meeting of the Board of Examiners at the same time.

After considerable discussion the amendment was carried by a vote of 12 to 6.

Moved by H. L. Esten, seconded by Charles J. Murphy: That any omissions or clerical errors in the record of the proceedings of this meeting, now in the hands of the stenographer and the Secretary, be corrected by the Committee on Publication before being printed. Carried.

Before taking up the matter of the nomination of officers for the ensuing year the meeting adjourned for ten minutes.

On re-assembling it was moved by Mr. Dickson, seconded by Mr. Jones: That Mr. Elihu Stewart be re-elected President for the ensuing year. Carried.

Moved by Mr. Niven, seconded by Mr. Gaviller: That Mr. M. J. Butler be re-elected Vice-President. Carried.

Moved by Mr. Butler, seconded by Mr. Sewell: That Mr. A. J. VanNostrand be re-elected Secretary-Treasurer for the ensuing year. Carried.

The following gentlemen were then nominated for the office of Auditors, two being required:—

Willis Chipman, nominated by Mr. Dickson, seconded by Mr. McAree.

H. B. Proudfoot, nominated by Mr. Niven, seconded by Mr. Foster.

C. J. Murphy, nominated by Mr. H. J. Bowman, seconded by Mr. Rorke.

F. L. Foster, nominated by Mr. Walker, seconded by Mr. Tyrrell.

The following were nominated for Councillors to take the place of the retiring Councillors, Messrs. Niven and Kirkpatrick:—

A. Niven, nominated by Mr. Dickson, seconded by Mr. Morris.

F. L. Foster, nominated by Mr. McAree, seconded by Mr. C. A. Jones.

G. B. Kirkpatrick, nominated by Mr. Walker, seconded by Mr. Tyrrell.

J. P. B. Casgrain, nominated by Mr. Miles, seconded by Mr. Esten.

T. B. Speight, nominated by Mr. Bowman, seconded by Captain Gamble.

The President then appointed Messrs. H. J. Browne and Captain Gamble scrutineers of ballots for the ensuing year.

The meeting being now open for the consideration of New Business, Mr. Abrey suggested that in future it be understood that the President should only hold office for one year instead of, as has been the custom, re-electing him for a second term. Some discussion followed, the general opinion being that things had better remain as they are and that the Association should not commit itself to any rule in regard to the matter.

In regard to the expenses incurred in connection with the annual dinner, some discussion took place. Mr. Bowman moved that a grant of $25 be made to the Entertainment Committee. This, however, was not supported, Mr. VanNostrand saying, that hitherto the Toronto surveyors had considered it nothing more than their share of the cost of the meeting, that they should make up any shortage which might be incurred in that direction, as a mark of appreciation of the visit of their fellow-members from other parts of the province, and thought that the old order of things should be continued.

Moved by Mr. M. J. Butler, seconded by Mr. Walker: That the thanks of the Association of Ontario Land Surveyors be extended to the members of the Canadian Institute for their kindness in giving us the use of their library. Carried.

The discussion on the subject of "Drainage Difficulties in the South-Western Municipalities of Ontario," introduced by Mr. Winter during the morning session, was then resumed, Mr. Winter addressing the meeting.

Moved by Mr. Dickson, seconded by Mr. McAree: That a vote of thanks be given Mr. Winter for his paper and for the very able address he has given us upon the subject. Carried.

Mr. Dickson then introduced the matter of licensed surveyors working for less than the regular tariff charges, and asked if there was any way of disciplining such members.

After considerable discussion it was moved by Mr. Chipman, seconded by Mr. Butler: That the incoming Council be hereby instructed to report upon the question of a minimum tariff at the next annual meeting. Carried.

It was then moved by Willis Chipman, seconded by M. J. Butler: That the Secretary-Treasurer be instructed to insert in the forthcoming Proceedings a statement giving names of all articled pupils who have passed since 1885, to whom articled, and date of said articles: and also a list of all Land Surveyors who have registered and withdrawn from the Association. Carried.

Moved by Mr. Niven, seconded by Mr. Sewell: That a vote of thanks be given to the President for the able and instructive address given by him in the opening part of the proceedings. Carried.

Mr. Dickson asked for information respecting an official standard measure, and the matter was discussed by Messrs. Abrey, Butler and Chipman.

There being no other business, on motion of Mr. Dickson, seconded by Mr. Tyrrell, the meeting was declared closed. 5.40 p. m.

MEMBERS IN ATTENDANCE AT THE FIRST ANNUAL MEETING.

Abrey, G. B.
Bolton, L.
Bowman, H. J.
Bray, E.
Browne, W. A.
Butler, M. J.
Chipman, W.
Dickson, J.
Ellis, H. D.
Esten, H. L.
Farncomb, F. W.
Foster, F. L.
Gamble, K.
Gaviller, M.
Gibson, P. S.
Gibson, H. H.
Hutcheon, J.
Johnson, R. T.
Jones, C. A.
Kirkpatrick, G. B.
Laird, R.
Lumsden, H. D.
McAree, J.
McCulloch, A. L.
McFarlen, G. W.
McKay, O.
McMullen, W. E.
Miles, C. F.
Morris, J. L.
Murphy, C. J.
Niven, A.
Paterson, J. A.
Proudfoot, H. B.
Roberts, V. M.
Roger, John
Rorke, L. V.
Sankey, V.
Silvester, G. E.
Sewell, H. DeQ.
Speight, T. B.
Spry, W.
Steele, E. C.
Stewart, E.
Stewart, L. B.
Tyrrell, J. W.
VanBuskirk, W. F.
VanNostrand, A. J.
Walker, A. P.
Whitson, J. F.
Wilkie, E. T.
Winter, H.

RESULT OF ELECTIONS.

President..............E. Stewart...............(by acclamation).
Vice-President ....M. J. Butler....... ......(by acclamation).
Secretary-Treasurer.....A. J. VanNostrand........(by acclamation).

Councillors elected for ensuing three years.

G. B. Kirkpatrick, A. Niven.

Auditors elected for ensuing year.

Willis Chipman, H. B. Proudfoot.

I hereby declare the above named Councillors and Auditors elected.

A. J. VanNostrand,
Secretary-Treasurer.

Certified correct.

H. J. Browne,
Killaly Gamble,
Scrutineers of Ballots.

REPORT OF SECRETARY-TREASURER.

Mr. President,—I beg to submit the following report of the business of the Association during the period between the annual meeting in 1892 and the present.

The number of active members of the Association of Provincial Land Surveyors of Ontario at its Seventh Annual Meeting, was 107; with 9 additional who were in arrears for one year only.

At the present time there are 173 full members of the Association of Ontario Land Surveyors, 20 others who have paid $1.00 with their application for registration, with request to have their names withdrawn from the list of practitioners, 29 who have applied for registration, paying the fee of $1.00, but omitting to state whether they wished to withdraw or to remain in a position to practise, and 3 who are in arrears for a portion of the annual dues for the first Association year, making a total of 225 Provincial Land Surveyors who have applied for registration under the "Ontario Land Surveyors' Act"

As nearly as may be ascertained from the list of Provincial Land Surveyors in the Crown Lands Department, there are 136 who have not applied for registration, but of these a large number have left the Province or are engaged in other occupations.

The following circulars have been issued:—

No. 39.	(Assoc'n of P. L. Surveyors,)	to the profession, *re* incorporation.	350	copies
" 40.	" " " "	Re Anonymous circular.........	200	"
" 41.	" " " "	Ballot for 1892–3..............	200	"
" 42.	" " " "	Explanation of Ballot...........	200	"
" 1.	(Assoc'n of O.L. Surveyors.)	Ballot for 1892–3..	360	"
" 2.	" " " "	Explanation of Ballot............	360	"
" 3.	" " " "	Announcement in '92 report.....	1000	"
" 4.	" " " "	To unregistered Surveyors.......	200	"
" 5.	" " " "	Respecting unpaid dues..........	150	"
" 6.	" " " "	Announcing annual meeting for '93	250	"
" 7.	" " " "	Programme for annual meeting..	250	"

In addition to the above about three hundred copies of the Ontario Land Surveyors' Bill, and three hundred and fifty copies of the Act as passed by the Legislature, were sent to the profession.

One thousand copies of the Annual Report for 1892, have been disposed of as follows:—

Sent to Members, Advertisers, Libraries, Newspapers, &c......	242
Sent to exchange societies....................................	665
Sold..	7
On hand at date	86
Letters sent from the Secretary's office.........................	670
Post-cards..	56
Letters and post-cards received	508
Exchange reports received and distributed.................. ..	795

In order to supply copies of all the exchanges to each of our members it will, in future, be necessary to make arrangements with the various exchange societies to have an additional number of their reports printed at the expense of our Association, as our membership exceeds that of any of our exchange societies.

I take this opportunity to express my thanks to the various standing Committees and in particular to the Committee on Publication. The labor of supervising all the details in the publication of the Annual Report must be experienced before it can be properly appreciated.

Accompanying this report is a statement of the financial transactions of the Association during the past year. All of which is respectfully submitted.

A. J. VanNostrand,
Secretary-Treasurer.

Toronto, 27th Feb., 1893.

STATEMENT OF RECEIPTS AND EXPENDITURES, BETWEEN 22nd FEBRUARY 1892, AND 27th FEBRUARY 1893.

1892–3

RECEIPTS.

To Balance on hand, 22nd February 1892		$173 97
" Fees for first Assoc'n year, 173 members at $5.00 each	$865 00	
" " " " " 3 " " 4 00 "	12 00	
" " " " " " 49 " " 1.00 "	49 00	
" " " second " " 2 " " 4.00 "	8 00	934 00
" Advertisements in '91 Report	9 50	
" " " '92 "	89 00	98 50
" Reports sold, 7 copies at 50 cts	3 50	
" Postage received for Reports sold	06	3 56
" Receipts *re* Board of Examiners		237 00
Total		$1447 03

1892–3

EXPENDITURES.

By Postage	$53 00
" Telegrams	75
" Printing Circulars, O. L. S Act, Stationery &c	80 50
" Publishing Report of Proceedings '92 Meeting	244 40
" Express and Freight *re* Exchanges	7 76
" Cartage	50
" Import Duty and Customs Brokerage	2 10
" Export Duty on Exchanges	1 00
" Typewriting	95
" Amount paid Solicitor, *re* Ontario Land Surveyors' Bill	100 00
" " " Secretary-Treasurer for 1891	40 00
" " " Stenographer for '92 Meeting	35 00
" " " Returning Officer in first election	25 00
" Rent of rooms for '92 Meeting	12 65
" Amount paid for Office Furnishings	18 90
" Expenses and Fees *re* Board of Examiners	109 15
" Balance	715 37
Total	$1447 03

A. J. VanNostrand,
Secretary-Treasurer.

Toronto, 27th Feb., 1893.

REPORT OF AUDITORS.

We hereby certify that we have examined the accounts of the Secretary-Treasurer, and vouchers therefor, also Financial Statement, and have found them correct.

WILLIS CHIPMAN, }
H. B. PROUDFOOT, } *Auditors.*

March 1st, 1893.

REPORT OF COMMITTEE ON LAND SURVEYING.

MR. PRESIDENT,—Your Committee on making the first Report to the Association under our new name of Ontario Land Surveyors, cannot but think, when so many new names have been added to our list of membership, that it is as well to mention some of the changes that have been accomplished and subjects discussed in former years.

In 1887, the new Act respecting Land Surveyors and Surveys of Land became Chapter 152 of the Revised Statutes of Ontario. In 1892, the Act to incorporate the Association of Ontario Land Surveyors was passed. Also in this year our Association affiliated with the Association of Dominion Land Surveyors. From time to time the following have been discussed, and we consider are worthy of some definite action being taken as to them.

Improvements as to the construction and registration of plans, especially as to the bearings and work required on the ground.

The establishment of an Ontario Meridian Line. The adoption of a Registered Private Mark, by Ontario Land Surveyors. Organizing a Boundary Commission.

The best method of drawing up descriptions and laying out Town Plots, and who should survey a Railway Right-of-way.

Many questions as to the Field work have been answered, and we would earnestly recommend all to take part in this, our important department, the "Question Drawer." That most complicated patchwork designated the Ditches and Water Courses Act, has engaged the serious attention of our friends of the Drainage Committee, and we have every hope that next session of the Ontario Legislature will provide us with an intelligible guide as to this department of our field work. Questions submitted and answers to same are annexed.

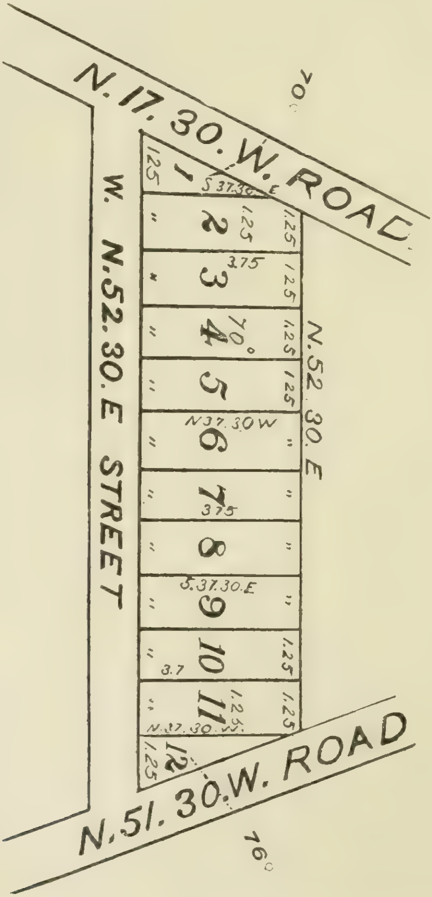
M. GAVILLER,
Chairman

QUESTION DRAWER.

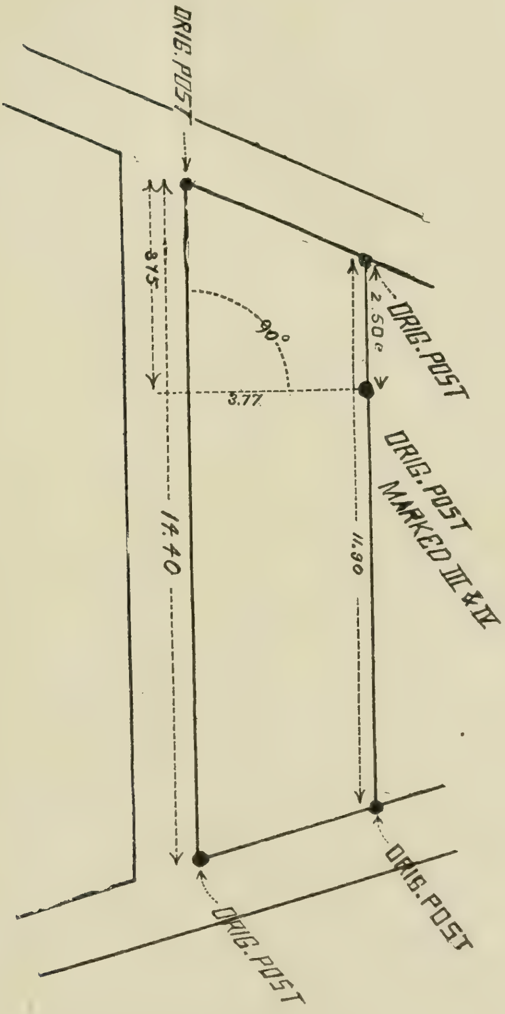
Question 1.—The principal points are, 1st, a shortage of 60 links across the block (corner indisputable), 2nd, a point between lots 3 and 4 at the *back*, also indisputable. It will also be noted that the lines (side) are to have a *fixed bearing*. Wanted the line between lots 3 and 4. *See Diagrams.*

Answer.—Assuming the plan to be registered, find point in front by proportional subdivision. Sec. 62 Surveyors' Act. Rear post already found.

FIGURE A.—Sketch of original plan.



Question 1.—How would you define the line between Lots 3 and 4?



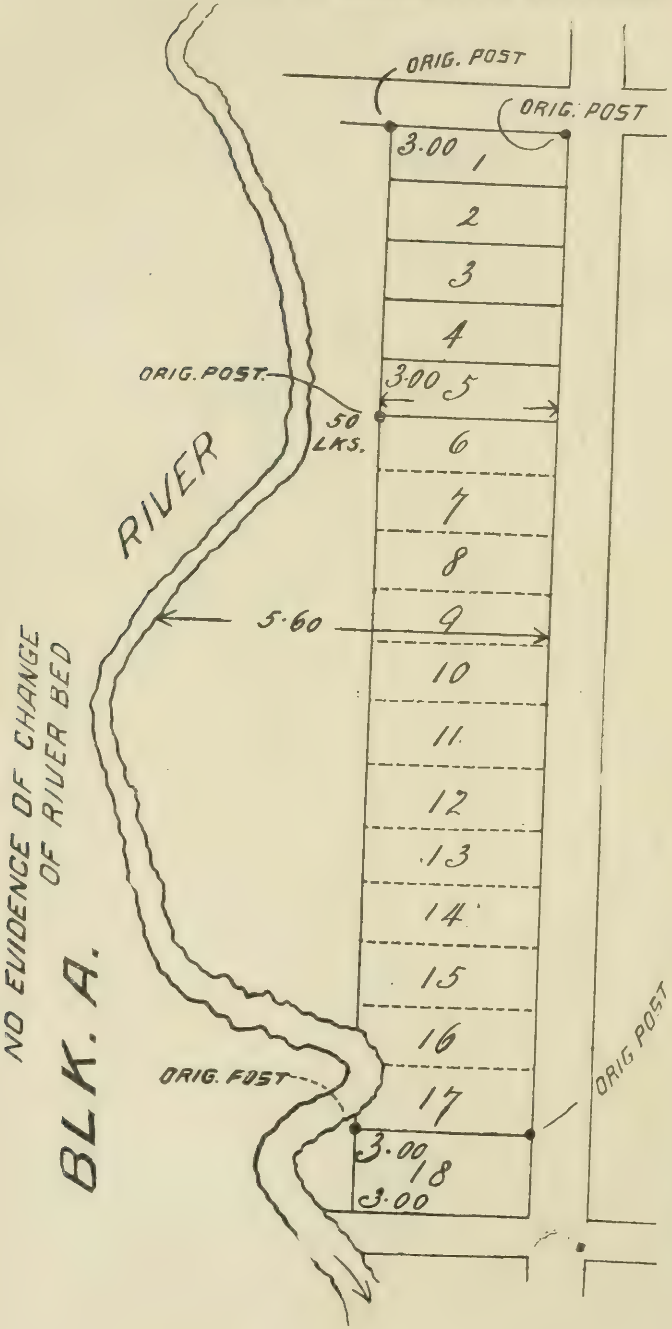
[*Question 1.*]

FIGURE B.—Sketch from actual survey.

Question 2.—1st, River only sketched on ice, original survey is evident, as it does *not* agree with place at all, except at lot 18; owner of block A denies that lots 6–17, should not at most be more than they scale on Reg. Plan; owners of lot 6–17 claims to go to the river.

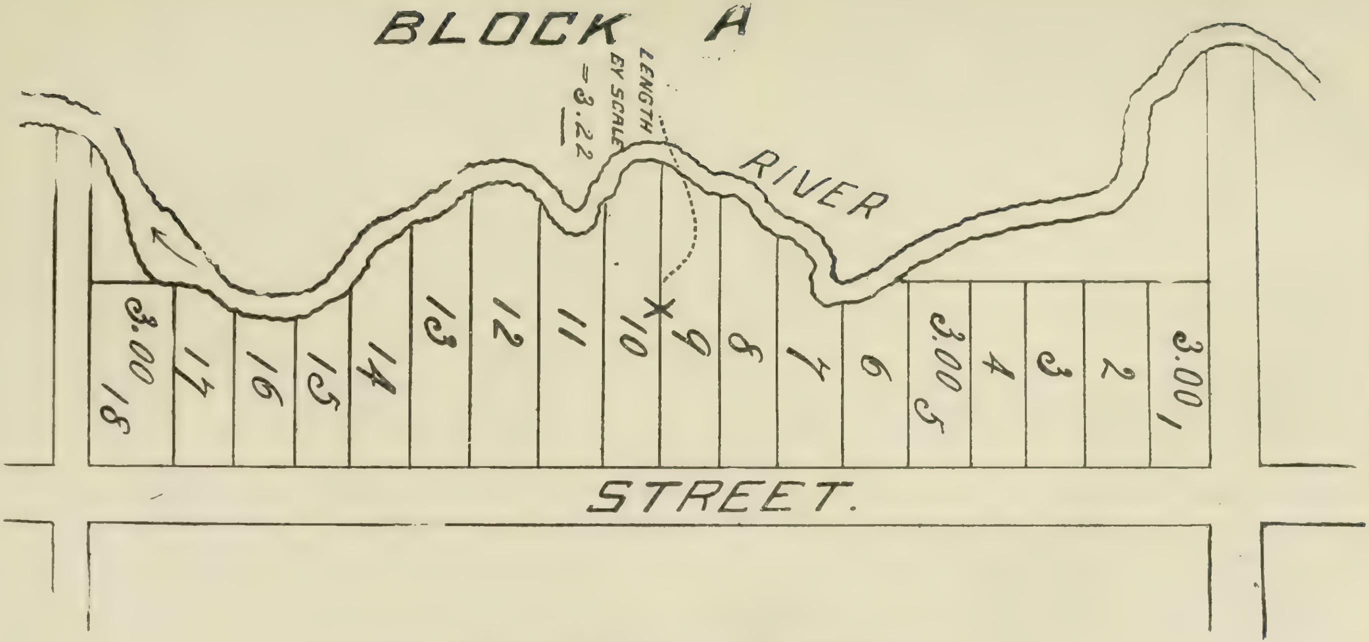
Are either right? See Diagrams.

Answer.—From data furnished the lot line should run through to the river.



Question 2.—Required the lengths of Lots 6 to 17 inclusive, but particularly between Lots 9 and 10.

FIGURE A.—Sketch from actual survey.



Question 2.—FIGURE B.—Sketch from registered plan.

Question 3.—Double front survey, base line north boundary. Lot 23, Con XIII, has no front on Con. line XIII and XIV on original plan and field notes. How should A B (line between West halves of lots 22 and 23, Con. XIII) be run?

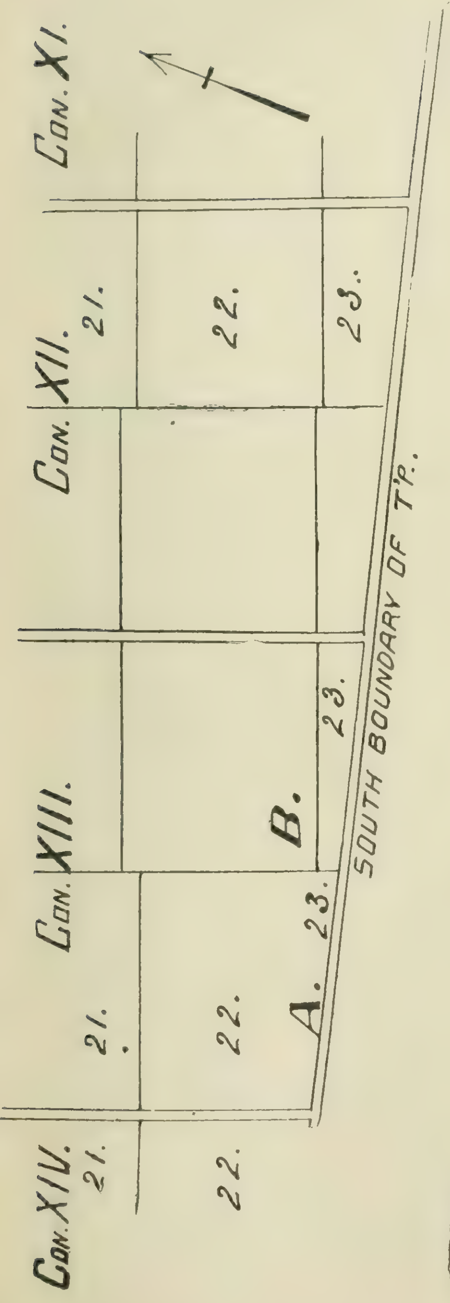
Answer.—Decisions given in court to be quoted in next Report.

Question 4.—Double front survey, base line West boundary. No posts planted in original survey on lake shore. How should A B C D and E F be run?

Answer.—Width of lots on Con. line XIII and XIV to be ascertained by proportional division on that line, and used as fronts for North half of Con. XIII.

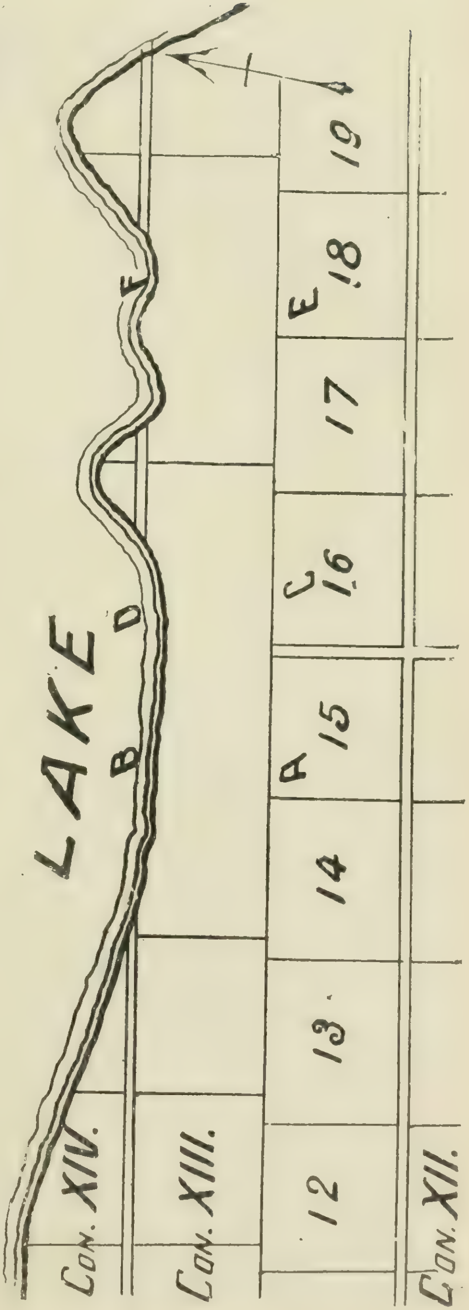
Question 5.—On January 26, '92, I was employed by A and B to form the line between lots 7 and 8, Con. III, Township. A, the owner of lot 8, made affidavit that he had seen the original post 18 years before, had buried underneath it a broken green-glass bottle. I measured both lots from undisputed posts, found lot 7 = 30.59 chains; lot 8 = 32.68 chains; they were each intended to be 30.00 chains. B, the owner of lot 7, insisted upon seeing the facts sworn to in the affidavit verified, and I refused to make the survey until the frost was out and a search made. On April 24, went back; the parties had dug, at a piece of wood which had been placed to mark the spot; and found two small pieces of green glass, 6 small pieces of smoky glass and 22 small pieces of crockery, also a small piece of cedar that might have been the decayed part of a post. A could give no explanation, and as the articles found did not verify the affidavit, I made an equal division and ran the line. On June 1st I was sent for again; the parties had again dug and found the glass as described in the affidavit, but 26 inches east, and 5 inches on the course of the side-line south of where the crockery had been found. I ran the line over again from that point. Was my last survey correct?

Answer.—The last point adopted was correct.



3

Question 3.



Question 4.

REPORT OF COMMITTEE ON DRAINAGE.

MR. PRESIDENT,—Your Committee on Drainage beg to make the following report thereon :

During the season of 1892, the most important work done in connection with drainage matters was the taking of evidence by the Commission, appointed by the Ontario Government, regarding the working of the present Acts in the different parts of Ontario.

The method adopted by the Commission for securing this evidence from the different parties interested, was exceedingly thorough as the Commission met the parties on their own ground, and patiently listened to the views and opinions of all sorts and conditions of men—Reeves, Councillors, Ratepayers of the highland and lowland type, President and non-President, Lawyers, Surveyors and Engineers—in fact, anyone who had a suggestion to make towards the improvement of the Act was cheerfully accorded a hearing. This work extended over the greater part of the last summer meetings, having been held in the principal towns of Western Ontario, and resulted in the accumulation of a mass of evidence that covered the subject pretty thoroughly. The Commission has completed its labours and the report of the work is in the hands of the Government, so that at the present session we may expect to have an Act framed that will meet all the different situations which confront an Engineer in designing drainage works.

At the present time the Drainage Act is and has been for the past year, in a chrysalis state and inert. As a consequence of this, active operations have been confined to repairs and the construction of small works, though the legal department apparently were unaffected, as appeals, and counter appeals before the Referee were the order of the day.

In that vexations question of "Outlet" in the Township of Raleigh, the adjoining Townships of Harwick and Tilbury, each assessed for outlet, appealed, but as yet no decision has been received by the Referee. The Township of Romney appealing from an assessment by Tilbury East for outlet was sustained by the Referee. The feeling evidently is gaining ground that the high lands should not be assessed as heavily as has been the custom heretofore. Doubtless, when the new Act is in force, drainage matters will again assume that prominence they attained a year or so ago, when it is to be hoped that the dangerous element of opportunities for litigation will be found to have been entirely eliminated, and that henceforth there will be no necessity to carry appeal cases to the "foot of the Throne," as has been done in the case of "Williams *vs* Raleigh," upon which a decision is promised by the Privy Council next July. It will be a hard matter to realize that this case is really ended, as for years past it has been looked upon as a standing institution in connection with drainage in Western Ontario. The old scheme of a canal across the plains from Lake St. Clair to Lake Erie has been revived, and application for a charter is about to be made at the present session of the Dominion Parliament. The annexed plan and description of the scheme will convey a good idea of the work and the effect it would have upon the large areas of marsh lands in its vicinity.

On behalf of the Committee on Drainage,

JOHN C. MACNABB,
Chairman.

QUESTION DRAWER.

To the Land Surveyors' Association of Ontario.

SELBY, Jan. 21, 1893.

Would it not be better if the Ditches and Watercourses Act be so amended that the Municipal clerks should keep a supply of forms, similar to Form D, and should furnish said forms to the owners of land that apply to him for the Drainage Engineer to appoint a meeting. Said owners to fill up the forms and serve them on each and all the parties interested.

Yours, etc.,
JOHN S. AYLESWORTH, O. L. S.

These forms are held and used by many Township Clerks at the present time.

RIDGETOWN, Jan. 18th, 1893.

DEAR SIR—I received from you a short time since an invitation to write something, or give some hints on some subject. I have nothing to write about unless the amendment of some of our laws.

I consider that our Municipal officers have too much power in appointing an Engineer under the Ditches and Watercourses Act. They can appoint any person they consider capable. I say we should have the work. The law makes us study and prepare 3 or 4 years and then give our work to any person.

And the law relating to holding land by possession—I consider it the most unjust law that could be enacted. A person may have a deed of land and pay taxes for a number of years, and another man along side have possession of a part and can hold it in spite of his deed. I consider it wrong; there is no use of having a deed.

I remain your obedient servant,
THOS. SCANE.

A. J. VanNostrand, Esq., Sec. &c., Association O. L. S.

DISCUSSION.

Mr. Bolton—So far as I can see, the questions that are here have nothing particular in them. This is one, "Would it not be better if the Ditches and Watercourses Act would be amended so that the municipal clerks could keep forms similar to the form D, and should supply such forms to land owners to fill up and serve them on each of the parties interested?" Up in our part of the country the clerks of the municipalities are all supplied with all the forms. In Listowel, the printing office publishes all the forms under the Ditches and Watercourses Act, and the clerks go there and get them.

Mr. Jones—In my experience most of the township clerks have those forms, that is, in the Western district, but still there are very often cases in which those forms will scarcely answer.

Mr. Wilkie—I am in exactly the same position as Mr. Aylesworth, who asked the question, seems to be in. Down in our country they have not any at all. However, we are not bothered with a great many cases.

Mr. Bowman—I understand that this Ditches and Watercourses Act is to be wiped out. If that is the case, we need not bother very much about the forms. The way the Act stands now, there are so many forms required that the notices and forms are more than all the rest of the Act put together. I would not trust any township clerk to make out forms to be served on parties that you could go into court on and say that the forms had been served properly. Whenever a difficult case comes up I get the interested parties to come to me and I write up a form that will suit myself and keep a copy of it, and have them served on the proper day; and if they cannot succeed in arranging the matter between themselves, I write out the requisition for them and then they could send that to the township clerk. If you are going into court there is no use trying to make an award when the preliminary notices are not correct

Mr. Bolton—In our part of the country they are printed exactly as they are in the Act, so there can not be any mistake about it.

Mr. Wilkie—Once in a while a case turns up where the form in the Act will not suit.

Mr. Bolton—There is another question which the Drainage Committee have not considered. It is, "What are the best methods of protecting the joints of agricultural drains, tiles of all sizes, 1½ inches to 12 inches in diameter, and laid in different kinds of soil?"

Mr. Butler—I have had some little experience in that in clay and sandy soil, and the plan I pursued was to take a piece of the cheapest class of cotton, three or four inches wide, and a couple of wraps around the joints and cover it with sawdust or straw on top, and I have never heard of one of them being choked. The size of the tiles was up to four inches.

THE FOLLOWING QUESTION WAS SUBMITTED BY MR. TYRRELL, WITH DIAGRAM ON BLACKBOARD:

In order to drain the swamp A, a ditch was cut across the high land on the road, and a great volume of water passes down through it from A, flooding E's property. There is a fall in the direction of E and also a fall in the direction of A. The question is whether the pathmaster had a right to cut that ditch through there at B, and if he had not, have I, as Township Engineer, a right to order it to be closed again and make A drain his own swamp? Now the water is carried into the road ditch, across the road, and flows off through E.

Mr. Bolton—I don't think an Engineer has any right to close any drain. He may order the opening of other drains, but I don't think there is anything in the Act to give him authority to close a drain.

Mr. Butler—I am sure a judge would soon order it closed.

Mr. Jones—I had a case somewhat similar to that this last year, and though I did not consider I had any authority to stop it up I did not tell them so, but I put it in the award that the drain was to be closed at a certain point and I believe they have done so.

Mr. Tyrrell—A claims that his water already comes out to the road, which it does. Then he claims that the township has a right to take it away from the road.

Mr. Jones—If the fall is in the other direction he cannot ask them to take it through the division of land.

Mr. Bolton—I know in our county E has good cause for bringing an action for damages. I know cases where they have got $2,000 and $3,000 in cases where it was not as bad as that.

Mr. Gaviller—I had a case like that where they asked me about it, and I told them to go and put a dam right in that ditch 6 to 8 feet thick so it would not wash away. They did that and there was never another thing about it.

DISCUSSION ON THE REPORT OF THE COMMITTEE APPOINTED TO CONFER WITH THE ONTARIO DRAINAGE COMMISSION.

Mr. Winter—Included in this report the report of a Committee that was appointed to confer with the Drainage Commission appointed by the Government appears. The chairman of this committee, has reported that the commission has completed its labors and the report of the work is in the hands of the Government, so that during the present session we may expect to have an Act framed that will meet all the different situations, which confront the engineer in designing drainage work. I will say this for the credit of the profession, or such members thereof as belong to the western country, that the engineers themselves have found no difficulty in designing the drainage works, that is, if their recommendations were carried out. But the difficulty is, that the municipalities going on with the construction of the drainage work in very many cases do not feel disposed to act upon the suggestions or recommendations of the engineer, but take a good deal of it into their own hands, and if the work turns out to be a failure, which it frequently or almost invariably does, they make him the scapegoat and blame him for it. I may say that in that section of the country where the suggestions of the engineer have been carried out, they are almost invariably a success: they are only failures where his recommendations have been set aside. At the present time the Drainage Act is, and has been for the past year, in a chrysalis state. Active operations have been confined to repairs or construction of small works, though the legal department was apparently unaffected, for appeals and counter appeals before the Referee were the order of the day. There are more expensive suits going on there during the whole year, so that we are in that unfortunate position, that our drainage works cost us more in law costs and in damages than the construction of the drains, and in that section of the country they are naturally very anxious that something should be done. I understand that there will be an attempt made to amend the drainage laws, to cover the difficulties I have indicated, and probably we could deal with the question more intelligently, if we had an opportunity of seeing the report of the drainage commission, but of course there will be no chance of seeing that until it is first brought before the Legislature. It strikes me that the important point that requires to be covered is this, the law requires to be amended in such a way that the party proceeding with the construction of the drain, will not be sole judge of where that drain should be located, and be constructed irrespective of the effect it would have upon other parties. In the construction of a drain where conflicting interests will probably arise, all parties interested in that drain should have a voice in deciding how the drain should be located and constructed, that is, those liable to suffer by the improper or unskilful construction of a drain, should not be obliged to wait until they actually sustain the damage, but have a right to interfere and restrain those going on with the work, in order that the matter might be so arranged that the drain would be constructed according to proper principles and no damage be done. That might be done in this way, by the Act making provisions for the appointment of a drainage inspector, either a drainage inspector for each county or a Board of inspectors for the whole province, so that whenever the question should arise as to the location or construction of a drain, that is liable to involve conflicting interests, the matter would be referred to an impartial authority of that kind. I think that there should be some disinterested and outside authority to decide questions of that kind, before the damage was actually sustained in order rather to prevent the mischief than to try to remedy it after it is done, by litigation and otherwise.

Mr. Tyrrell—It appears to me, that in the cases referred to this morning, by Mr. Winter, the difficulties occurred chiefly through the entire system of drainage not being properly designed in the first place. The drains were not constructed to proper outlets and afterwards the outlets were constructed and caused trouble to the original drains. The whole system appeared to have been done in a botchwork sort of way. However, it was probably not the fault of the engineers, as he explained, but there would have been no trouble if the whole system had been properly designed in the first place and constructed after that design.

REPORT OF COMMITTEE ON ENGINEERING.

MR. PRESIDENT,—Your Committee on Engineering beg to report that they have not, this year, been able to have a satisfactory meeting, and believe that the other standing Committees have had similar experiences. Your Committee would therefore recommend that a change be made in the programme for next year, so that the standing Committees may meet on the afternoon of the first day and report to the Association the next morning. All of which is respectfully submitted.

G. B. ABREY,
Chairman.

DISCUSSION.

Mr. Abrey—I think there should be some scheme by which the members of these Committees should get together and make their report the first day. About the only way these reports can be satisfactorily got in at present, is for the chairman or some person simply to constitute himself the Committee and make the report.

Mr. Bowman—I think that something in that line must be done.

Mr. VanNostrand—It may not be out of order for me to suggest that the committees try to do a little of the business by correspondence. There must be some things that occur during the year that can be attended to without everything being left till the time of the meeting. If we have a Committee, we have it for a certain purpose ; and it would, perhaps, be better for the other Committees to collect material during the year, as the Land Surveying Committee has done heretofore. The Land Surveying Committee is, of course, the one that is nearest to our interests, and theirs has always been a very interesting report. If the other Committees could keep the matter in mind and do a little corresponding amongst themselves during the year, it would facilitate the getting out of the reports.

The President—When this proposal was made, the intention was that these questions be sent to the Chairmen of the several Committees, before the meeting, so that they would be prepared to come to a finding on them when they did meet But any question that comes up during the meeting, such as Mr. Tyrrell's question now, we could scarcely expect the Committee to come to a finding on it. It would be a very great advantage if these questions could be sent in to the Chairman sometime before, so that they would be before the Committee at least at the first meeting.

Mr. Butler—I wish to say a few words in regard to the reports of the Engineering Committee. From year to year that Committee has felt a certain amount of difficulty in knowing what their duties were. Now, they cannot be expected to act as consulting engineers to all the engineers in the province ; the field of engineering is too broad, including as it does, the great powers of nature converted to the use and convenience of man. There are certain kinds of engineering confined to the members of this Association, but it seems to me that it is entirely within the province of the Engineering Committee of this Association, to deal with the question of our roads and country bridges and work of that class. I think that questions pertaining to these subjects might be brought before them, and they might embrace in their reports each year some suggestions as to that part of the work, and if that were done our Engineering Committee's report would be just as interesting as any of the others, and it would have also an educational value that it does not now possess.

REPORT OF PUBLICATION COMMITTEE.

Mr. President,—Your Committee have to report as follows:

The "Proceedings" for 1892, were printed by C. Blackett Robinson, as usual.

Our exchanges are about the same as last year's. See list below.

Your Committee would again ask for help in getting advertisements, and hope the members of the profession will patronize those advertising with us. We would suggest, that where a paper is accompanied by a diagram illustrating it, a copy of such diagram on a sufficiently small scale to put into the report be attached to the paper.

EXCHANGE LIST.

	RECEIVED FROM.	SENT TO.
Ohio Society of Surveyors and Civil Engineers	130	130
Illinois Society, Engineers and Surveyors	100	110
Indiana Engineering Society	140	80
Iowa Engineers and Surveyors' Society	125	45
Michigan Engineering Society	150	140
School of Practical Science, Engineering Society	150	150
Association of Domininion Land Surveyors	...	10

Respectfully submitted,

H. L. Esten,

Chairman.

Carried.

DISCUSSION.

Mr. Esten—I would suggest that any person sending a question in to the Question Drawer, with a plan attached, should also attach a small plan on a scale suitable for putting in the Report, as it is a good deal of trouble for the Committee to plot all these plans on a suitable scale.

REPORT OF COMMITTEE ON ENTERTAINMENT.

Mr. President,—The Entertainment Committee for 1892-3 have to report as follows:

The annual session of the Association for 1893, was held on Feb. 28th, March 1st and 2nd, in the Lecture Room of the Canadian Institute, which, though smaller than the Library in the same buiding in which the sessions for some years past have been held, is more conveniently fitted for the purpose of our Association, being provided with raised platform, blackboard, tables, reading desk, etc., and appeared to give general satisfaction.

With a view of ascertaining the wishes of the members of our Association in regard to the annual dinner, and of being able to judge as to the probable attendance, a precaution very essential to the success, pecuniary and otherwise, of such an entertainment, printed slips to that effect, and addressed postal cards were sent to all the members. And although replies from thirty-four were received, regretting their inability to attend, the answers of twenty-eight others who intended to be present on the occasion, decided the Committee in favor of the usual dinner, which was held on the evening of March 1st, at the Arlington Hotel.

Thirty-six, including five invited guests, were present to partake of the good things provided by our host, Mr. Matthews, who had evidently exerted himself to please all concerned.

Of seven invited guests five were present, including Mr. Aubrey White, Assistant Commissioner of Crown Lands; E. H. Keating, City Engineer, of Toronto, and Mr. W. A. Lee, President of the S.P.S. Engineering Society.

Letters regretting inability to attend, were received from The Hon. the Commissioner of Crown Lands, and Prof. Carpmael, of the Meteorological Observatory.

Some excellent speeches by members and invited guests contributed greatly to enhance the general pleasure and satisfaction evinced on the occasion, in reply to the various toasts prepared by yourself as Chairman, Mr. M. J. Butler as Vice-Chairman, and others, among which were the following: “Canada,” responded to by Prof. Galbraith, H. Winters and J. Dickson; “The Ontario Legislature,” responded to by A. Niven and Aubrey White; “Engineering Societies,” by W. A. Lea, C. H. Keefer and E. H. Keating; “Association of Dominion Land Surveyors,” by Willis Chipman; “Association of O. L. Surveyors,” proposed by A. White and responded to by Messrs. Stewart, Butler and Dickson; “The North-West Intelligence Corps,” responded to by H. B. Proudfoot and H. D. Ellis; “The Ladies,” by Messrs. Tyrrell and Macdougall; “The Entertainment Committee,” proposed by Mr. G. B. Kirkpatrick and responded to by Messrs. Foster, Ellis and Murphy; “Our Secretary,” proposed by Mr. Chipman and responded to by A. J. VanNostrand. Songs were sung at intervals by Messrs. Niven, Sewell, Bowman and Foster.

A detailed account of Receipts and Expenditure of all moneys in connection with the business of the Entertainment Committee has been handed to the Secretary, Mr. VanNostrand, and can be seen at his office by any member.

All of which is respectfully submitted.

On behalf of the Com. on Entertainment,

FRED L. FOSTER,
Chairman.

REPORT OF COMMITTEE ON LEGISLATION.

MR. PRESIDENT,—Your Committee on Legislation have little new matter to report, as the Legislation obtained is now familiar to all.

It is a matter for congratulation that "Incorporation" has been so well received by the majority of those who had not expressed themselves prior to the passing of the Ontario Land Surveyors' Act.

Upon a second reading in the Legislature, some slight changes were made in the Bill as presented to the Association of Provincial Land Surveyors of Ontario, at its meeting in February last. These changes were in some cases beneficial to the profession, and met with the full approval of your Committee, and in other cases were assented to as being necessary to the passing of the Act.

With minor alterations, which would remove certain slight ambiguities, and which may be made at a future Session of the Legislature, your Committee beg to express the opinion, that in the Ontario Land Surveyors' Act we have a measure which bids fair to be of great benefit to the profession, without being in any way prejudicial to the interests of the public.

Respectfully submitted,

JAMES DICKSON,
Chairman.

DISCUSSION.

Mr. Dickson— I may say that the matter referred to here is owing to a trifling cause. One portion of the Act fixes the date on which we hold our annual meeting, and another portion leaves the fixing of the date with the Council. There is another matter I want to mention, which brings prominently out the necessity of what Mr. Abrey has said about any questions to be taken up in the report of any of the Committees, that they should be submitted to the Chairman sometime prior to the meeting, so that they can be prepared.

Mr. Tyrrell has drawn my attention to a matter that I think we have all met with, that is the uncertainty of the law where municipal surveys are made. Of course we are all aware that they are made under the instructions from the Crown Lands Department. A great many surveyors were, and some are still under the impression that once a survey is confirmed it is final. Now the courts have decided that it is not final, and I have just heard of a case, where they have overthrown a survey altogether after it has been confirmed by the Commissioner of Crown Lands. I think we should have some Legislation to meet those cases. I would be glad if the gentlemen would just think the matter over during the coming year that it may be embodied in the next report.

Mr. Tyrrell—I might just refer to the statement made by Mr. Dickson with regard to confirmation of Crown Lands surveys. As he says, Crown Land surveys are no better than other surveys, as perhaps, we have all had occasion at one time or another to find out. Up in Wentworth, within the last few months, a very extensive and expensive survey was entirely upset, by a recent survey made by myself and Mr. Abrey. It seems to me it would be very desirable to have the Act so amended that when a survey is confirmed it would be final.

Mr. Sewell—There is another matter, and that is the way in which the Crown Lands Department is limited in making these surveys. The Act only provides for a very partial survey, and where there is any extensive work required the Department really has no power to authorize it.

REPORT OF COUNCIL, 1892.

Mr. President,—The first meeting was held at the Crown Lands Department on Oct. 18th, 1892, the members present being Hon. A. S. Hardy, Messrs. E. Stewart, P. S. Gibson, M. Gaviller, J. McAree, V. Sankey, A. Niven and G. B. Kirkpatrick.

The Council proceeded to organize as follows:—

Mr. V. Sankey was appointed Chairman.

The Hon. A. S. Hardy, Commissioner of Crown Lands, informed the meeting that the members of the Board of Examiners to be appointed by the Lieut.-Governor were Messrs. M. J. Butler and G. B. Kirkpatrick. The Council then appointed the following members:—Messrs. P. S. Gibson, A. Niven, R. Coad and M. Gaviller. Professor Coleman was appointed examiner in geology when required.

The Secretary-Treasurer was authorized to procure the necessary books and forms. He was also directed to deposit the funds of the Association in the Imperial Bank (Yonge St. branch), all cheques to be countersigned by the President, or, in his absence, by the Chairman. It was also decided to require him to give bonds to the amount of one thousand dollars, said bond to be in the custody of the President until proper provision is made therefor by the Association.

A draft of proposed By-laws has been drawn up and will be presented for discussion and ratification at this meeting.

The first examination was held at the Crown Lands Department commencing November 7th, 1892. The following gentlemen, having passed the final examination, were duly sworn in as Ontario Land Surveyors:—Thos. Russ Deacon, North Bay; Thos. Alexander Moore, London South; William Newman, Windsor; and George Ernest Silvester, Ringwood. Mr. Wm. Ernest McMullen, Toronto, who passed at the last meeting, was now sworn in. The following gentlemen passed the preliminary examination:—George Spencer Abrey, Toronto Junction; Abraham Silas Code, Glencoe; and Marshall Willard Hopkins, Stoney Creek.

The Council wishes to draw the attention of the Association to the work which devolves on the Secretary-Treasurer, who now also acts as Registrar, and considers it is only right that a reasonable remuneration for the Secretary-Treasurer should be fixed by By-law.

In conclusion the Council would urge all members of the Association to unite in furthering its welfare; now that we are fairly launched with full powers of self-government. Any member having any suggestions to make for the good of the Association should not wait until the annual meeting to express his views, but should communicate with the Chairman or the Secretary, who will submit the same to the Council. It is only in this way that members of an Association like this, who are dispersed over the whole Province, can unite to bring about the results in which we all have such a deep personal interest.

Respectfully submitted,

VILLIERS SANKEY,
Chairman.

Mr. Sankey—There is another matter which I wish to bring before you to-night. It is this, you are no doubt aware that now we have become an incorporated Association there is a lot of business which takes, compared with what our old Association did, a thoroughly business form. Our Councillors have really, under the Act and under the by-laws as proposed, and I believe it is in the interest of the Association that they should have, a strong controlling interest in the welfare of the Association. They are, as you all know, elected by the popular vote of the Association, and they should have the best welfare of the Association at heart. Now, it is not in the interests of the Association, that only Toronto men should be on that Council; it is clearly necessary that the profession at large should be represented from all sections of the province, from north and south and east and west; and I am very glad to see that the Council, as at present constituted, does fulfil that requirement. But, when you come to think of it, one meeting like this in the year is not sufficient to carry on the business of the Association. Under the by-laws it is suggested that there should be three regular meetings of the Council, one at our Annual meeting, and one at both the meetings of the Board of Examiners. This is something that I bring personally before you; it is not a matter that has been discussed in the Council at all; but I do think that it is nothing but right that the actual travelling and hotel expenses of members of the Council who live outside of Toronto, should be paid by the Association. I am a Toronto member, and I don't think any Toronto member expects to be paid for any time he gives. I don't know that any surveyor asks for that, but I think it will occur to you as it does to me, that it is not reasonable to ask a surveyor away in the east, west, or north, to pay his travelling expenses and hotel bill in Toronto and still be working for the good of the Association in which we are all interested I hope some member will bring this up and make such suggestions on a purely business basis.

The President—I wish to emphasize the desirability of what Mr. Sankey says. As he says, it is a very different thing now from what it has been heretofore.

Mr. Dickson—I cordially agree with what he says about paying the expenses of members of the Council. I think further, it is very unfair that any gentleman should be brought from a distance to work for nothing. I think not only those coming from a distance, but those residing in the city should be allowed something for their lost time.

DISCUSSION ON RATIFICATION OF BY-LAWS.

On the Ratification of the By-laws, the by-laws submitted by the Council of Management being taken up separately and passed clause by clause.

" The standing committees shall be the Committee on Land Surveying, Committee on Drainage, Committee on Engineering, Committee on Entertainment, Committee on Publication."

Mr. Chipman—I would move that the word " Engineering " be struck out, and the words " Topographical Surveying " be inserted instead.

Mr. Dickson—I would move that the words " Topographical Surveying " be added in addition to what is there already.

Mr. Niven—I would second Mr. Dickson's motion.

Mr. Bowman—I think that should be tacked on to the Surveying Committee; they should take that question up, not the Engineering Committee.

Mr. Gibson—I will second Mr. Chipman's motion.

Mr. Chipman—My object in asking this, is this, we have a Canadian and American Society of Engineers, and quite a number here are members or associate members of those bodies, and I know this, that there are members of the Canadian Society of Engineers who are possibly a little jealous of this Association, thinking we are trespassing on their ground; and I think we have quite enough to do without touching engineering work proper. I think this topographical surveying will keep this committee fully employed in securing data and facts and figures to present to this Association at its successive meetings. They have enough work ahead to keep the committee employed for several years before we can expect to get the Legislature to give a grant for the work. It is true we have had several papers on engineering subjects in the last few years, but so far as the Engineering Committee is concerned it is a useless body.

Mr. Gaviller—In what position would you place the unfortunate township engineers? Are they going to drop the title "Engineer" altogether?

Mr. Chipman—I think not, but that comes under the Drainage Act. We are aspiring to have a triangulation survey made of the province, a geodetic survey followed by a topographical survey. The present Committee on Surveying has its hands full. At every meeting the report of the Committee on Land Surveying is the most voluminous and takes up more of our time than anything else.

Mr. Bowman—I have been a member of the Engineering Committee for several years, and I have felt that it has done very little, still I don't think it is the fault of the committee, but the fault of the system, in not having a special day for the committees to meet. I think every committee appointed should meet on the first day of the session, which should be taken up entirely by committee meetings. There is no use having the members here for three days when really part of the time is taken up in preparing committee reports. This way the committees are blamed for what is really not their fault at all.

Mr. Gibson—I think the trouble is this, we try to do it all by talking. I think when these questions come up they should be sent by post to the members of these committees. However, Mr. Chipman and I will withdraw our motion on condition that the other motion remain.

Mr. Chipman—But if it is "Engineering and Topographical" I would move an amendment that you insert a standing committee on Topographical Surveying.

The President—Will that meet your views, Mr. Dickson?

Mr. Dickson—Yes.

Mr. Sankey—I will second that.

(The by-law was then carried, with the addition of the words, "and Committee on Topographical Surveying.")

As to the examinations, "Candidates for admission to practice, etc."

Mr. Sankey—Shall we leave the marks to the Board of Examiners to settle?

Mr. Butler—As to the subject of trigonometry, spherical trigonometry, I think perhaps, as a member of the Board of Examiners, it might be wise to get an expression of opinion from the surveyors assembled as to how much that includes. That is a pretty flexible term. Plane trigonometry covers a large subject, so does spherical. How much of each should be given?

Mr. Gibson—The practice has been the ordinary rules of plane trigonometry and demonstrations of such rules.

Mr. Butler—But partly the object of getting this Board of Examiners has been to make it a little harder to get through.

Mr. Dickson—I think it should be altogether left in the hands of the Board of Examiners.

Mr. Sankey—I think it would be advisable that these by-laws should be distributed over the country, and when a candidate writes to the secretary, asking how much of this have I got to do, or what books have I got to read? the Secretary will just send him a copy of the by-laws. And I think the Board of Examiners should be asked to define the particular chapters of each book, and I would advise that they put in this by-law the actual works that it is advisable for the candidate to read. I know at the last examination some candidates had been reading on one book and others on another. In one case, one gentleman came up for examination in Euclid. and I happened to have the Euclid I personally knew best, and in the course of the examination he said: "I don't think the Euclid you are looking at is the one I have been reading; it is one I don't know anything about." I thought in justice to him I should take the book he had studied out of, and I found he was thoroughly well posted in it; but the class of question I was asking was not the one he had been led to expect. I think it is decidedly advisable that the candidates should have some idea what books they are going to be examined out of before they come up.

Mr. McAree—Besides the proof of the rules I think they should go on to calculation of logarithms, say about half of Todhunter's book.

Mr. Walker—I think it would be well to insert there the names of a few text books that would be used in this examination.

Mr. Gibson—Suggestive only though.

Mr. Walker—I think it is usual to have a list of text books which may be used. We don't want to compel them to use any one particular one, but I think there might be a list, which will be used as a basis for the examiners in this examination.

Mr. Gibson—There is no question but they must be examined in the studies they have gone through in the schools.

Mr. Bowman—I move that the Board of Examiners be authorized to issue a printed prospectus of the different subjects and text books recommended by them for the preliminary and final examination.

The President—There is an examination in plane superfices, and it seems to me there is nothing in solids; the idea of a surveyor going through and not knowing how to measure a cube or a sphere does not seem right.

Mr. Dickson—In suggesting that the Board of Examiners or secretary notify students as to what they shall study, suppose they should clash with what is ordered to be taken up in the schools, how would that be?

Mr. Gibson—The Board will send out a circular with reference to these points.

Mr. Walker—I think the way that is usually done in universities and schools of science is to mention what parts they are to get up; for instance, trigonometry, the relation of the parts of triangles, logarithms, and the solution of triangles; and then anybody would see what they had to get up, and use what text book they like.

As to number of marks candidates must obtain.

Mr. Abrey—Is it the intention that candidates shall know their standing after the examination—know the marks that they have obtained?

Mr. Sankey—I may say that any candidate can see now.

Mr. Sewell—I think the percentage ought to be at least seventy-five per cent.

Mr. Walker—What are the percentages now in the examination?

Mr. Sankey—Not less than one-third was what we were governed by at the last examination.

Mr. Ellis—On one or two of the subjects I think one-third is too low.

Mr. Walker—I think as this matter has been left to them that this clause had better be left to the Council also. I suppose we are not going to decide at this meeting what number of marks on each subject is to be the maximum, and it would be as well to leave this to the Board too

Mr. Sankey—Then this clause referring to examinations is to be referred to the Council.

With regard to discipline.

"Any complaint against a member of the Association or against any other person, etc."

The President—It seems to me that is indefinite, "any other person."

Mr. Sankey—In section 5 of the Act there is a very long clause, setting out what powers the Council have for suspending or dismissing from the Association any land surveyor who is found guilty of gross negligence or corruption in the execution of the duties of his office; but the Council shall not take action until the complaint made under oath has been filed with the secretary. That governs the powers that the Council have with regard to any member of the Association. Now, the Council understood that it was the wish of a large number of the members of the Association that a by-law should be passed, giving the Council authority to take up any complaint of this kind and prosecute it against an unlicensed practitioner in any part of the province.

Mr. Winter—As the statute stands at present, could not any member of this Association do it?

Mr. Sankey—Yes; but private members don't like to do it.

Mr. Dickson—I think it should be that when any member of the profession finds any interloper coming in and working, he should simply report it with all the facts of the case to the Council and let them prosecute him. It is astonishing how many employ these characters. I know I have had to go over a lot of their work again, and I never found it correct. But at the same time it is a very unpleasant thing for any individual surveyor to prosecute. They will write a description of a piece of land, and all the surveyors in this room could not find that land.

Mr. Sewell—It is a question whether the description of land does come within our province. I have never been clear as to whether any person could be legally allowed to write out a description.

Mr. Sankey—I think we are in the same position as the lawyers are with regard to conveyancing.

Mr. Dickson—Lawyers find a great deal of fault with others doing conveyancing, but I have had some experience with lawyers, men with Q. C. attached to their names writing descriptions, and it would be impossible to find the land.

Mr. Sankey—Then it will be, "Any complaint against a member of the Association or against any unlicensed practitioner shall be filed with the secretary . . . . at the next regular meeting of the council."

Mr. Winter—How is the council going to have power to summons before them any party that is not a member of this Association ?

Mr. Sankey—They have not the power; they just rely on the truth of what they are told and make such investigation as they may have the power to make as to the truth, and then if they see reasonable grounds for commencing a law suit they will instruct it to be commenced.

Mr. Winter—What power does the statute itself give this Association to deal with parties that do not belong to the profession except just as the statute provides ?

Mr. Sankey—It is not proposed that it shall ; it does not give them any power at all. Any licensed practitioner has the power to bring him up before the proper courts and have him punished, and the object of this Council is to see if there is sufficient evidence to warrant them bringing him up.

Mr. Sankey—I would like to draw your attention to this in our Act, "The Association may by by-law provide that any surveyor who has been in the actual practice of his profession for a period of thirty-five years or more, and has during the entire period been a duly qualified surveyor, may be exempted from the operations of this Act." It has been thought that perhaps it would be advisable to have a by-law passed which would enable any members of the Association who wished to avail themselves of that privilege to do so, instead of having to pass a new by-law every time a man makes application ; that a by-law could be passed now, leaving the matter with the Council.

Mr. McAree—Suppose we limit the date up to which they may apply for the benefit of it.

Mr. Winter—If I recollect the reading of the statute it strikes me that that is a matter for the Council.

Mr. Sankey—When we were about getting that Act passed some of the older members of the profession wrote to us and to the Government, saying that they had been practising long years and thought it was hard lines that they should be brought under the provisions of the Act proposed, and asked if a clause like this would be acceptable.

Mr. Winter—I think it would be wisdom on the part of the Association to deal with the matter very carefully Supposing quite a number should make that request and be freed from the control of the Association.

Mr. Gibson—Does not that apply to persons who had been 35 years practising before the passing of the Act ?

Mr. Sankey—Yes.

Mr. Bolton—That only refers to the fees.

Mr. Sankey—It is "the operation of the Act." It means he can go on and practise without paying his fees.

Mr. Niven—I think the intention of the Act is that they remain in all respects as they are, except that they do not pay their $4 a year.

The by-laws were passed as a whole.

DISCUSSION AS TO PAYMENT OF MEMBERS OF COUNCIL.

Mr. Morris—It has been moved by Mr. Foster, seconded by myself: That the members of the Council of the Association of Ontario Land Surveyors be allowed all reasonable expenses and $6 per day while in attendance at all meetings.

This is the outcome of a recommendation or hint by the Chairman of the Council in bringing in the report, that it was hardly fair for members of the Council to come to Toronto and receive no remuneration, while others who are members of the Board of Examiners receive remuneration similar to what I have proposed here. I think it is now compulsory on the Council holding their meetings twice a year, at the same time as the meetings held by the Board of Examiners The third meeting of the Council is at our annual meeting. The question may arise, why should the Council receive remuneration at the annual meeting, while other members of the profession, attending at their own expense, receive none ? Well, this is only one-third of the question. The remuneration for the other two meetings is not going to add materially to our expense, if we look at it in this way: the Board of Examiners pay probably two-thirds of the Council at those two meetings, and the only expense, coming on this Association will be for that part of the Council not receiving remuneration as on the Board of Examiners, so that though this may appear a tax on the Association, it is probably not more than a little over one-third of what it would appear here.

Mr. Abrey—I suppose it is not the intention where members of the Council are also members of the Board of Examiners to pay them twice for the same meeting?

Mr. Foster—No, that is not the intention. It is only those members of the Council who are not on the Board of Examiners. The Board of Examiners get their pay irrespective of their being on the Council at all.

Mr. Winter—It strikes me that that motion leaves the matter in a rather unsatisfactory shape, because there is nothing to prevent the members of the Council, if they happen to be members of the Board of Examiners as well, receiving pay twice over. I believe that all our officers ought to be reasonably paid for all the services they perform, and I have no objection to the motion, but it leaves the matter rather doubtful. It would be better to add something to that motion to explain that point.

Mr. VanNostrand—I think it would be better to make the motion a little more explicit. Of course we don't suppose there will be any difficulty of that sort, but there may be objections from parties who do not understand this as well as we do ourselves.

The motion was then changed to "That the members of the Council of the Ontario Land Surveyors be allowed all reasonable expenses and $6 per day while in attendance in their capacity as Councillors at all meetings, except the general annual assembly of the Association."

Mr. Bowman—I move in amendment, seconded by Mr. Miles: That the members of the Council be paid all reasonable expenses in coming to, attending and returning from Council meetings. No member, also a member of the Board of Examiners, to be paid railway fare when attending a meeting of the Board of Examiners at the same time.

If the motion is carried, we don't know what sum we may be let into. A member coming from a distance will be a day here, a day coming and a day going back; and some of their railway fares will amount to $20, so we will have $40 or $50 apiece for every meeting, and we don't know how the members will attend, there may be 6 or 7, so it will take a large sum to pay them. I am quite in favor of paying all reasonable expenses, but for the first year, I think that is quite sufficient. If we find after the first year that we have a big balance on hand and don't know what to do with the money, then it will be time enough to pay the Council.

Mr. Winter—My experience in matters of this kind is this, that if we undertake to shave down too closely the fees of the officers that are to do our business, we are making a great mistake, because we will never have our business properly attended to. I am fully convinced in my own mind, that if the revenue of the Association is not sufficient, according to the present arrangement, to pay a reasonable remuneration to the officers that attend to our business, we had better make such amendment as will make it sufficient, in order that we pay reasonably for all services and have them performed in a proper manner, and be under obligation to nobody.

Mr. Bowman—We had better find out something about what is done in other societies. It is a matter that is going to affect this Association a great deal one way or another, and I would like to know what is done in the Canadian Society of Civil Engineers.

Mr. Walker—As far as I know, there is no salary attached to the Council of the Canadian Society of Civil Engineers. They do not even receive travelling expenses; it is all done for the honour.

Mr. Morris—It is true it is all done for the honour, but the Association of Civil Engineers so far is all honour and sentiment. This is hard work. The officers of this Association have a great deal of work to do that the Canadian Society of Civil Engineers have not. And it is more of a democratic institution in this way, that the officers are taken from all over the province indiscriminately, whereas in the Civil Engineers it is more centralized and the officers are chosen so that there will not be too much travelling. I don't think they are at all parallel cases.

Mr. Walker—I think Mr. Morris is a little mistaken about the officers being selected in that way. The Council, I think, as far as I recollect, is selected from each of the provinces. There are members of the Council who live in British Columbia, there are other members in Nova Scotia.

DISCUSSION ON MR. WILKINS' LETTER *re* UNLICENSED SURVEYORS.

In regard to Mr. Wilkins' letter as to unlicensed surveyors, also the signing by Ontario Land Surveyors of plans certifying to surveys made by unlicensed persons,

Mr. Bowman said—I was under the impression that the Act named an officer to look after and prosecute unlicensed surveyors, but I can't find it just now. I think there should be some one appointed to act on behalf of the Association and prosecute these persons. There is a great deal of farm surveying done by persons who are not licensed, and we cannot take it up ourselves, because the whole neighbourhood would be down upon us; but if an official of the Association were to prosecute them, there would be nothing thought of it, and it is no more than right that it should be stopped. I would move that an officer be appointed in compliance with the request of Mr. Yarnold to prosecute on behalf of the Association the unlicensed surveyors throughout the province.

Mr. VanNostrand—I think that matter is being touched upon if not covered by the by-laws.

Mr. Tyrrell—It is a matter that concerns us all more or less, and is rather important, so that I would be very much pleased to hear that the matter is put in such a shape that it will be enforced. I know just around the district where I practice there are, at least, four such men, who are continually practising, doing anything they can get hold of in the way of surveying.

Mr. VanNostrand—I think that our members are liable to lose sight of the fact that we are not acting for our own interests alone, we are acting partially in the interests of the public. We are servants of the public in a sense, and it is certainly in the interests of the public that unregistered or unlicensed surveyors should be prevented from practising. The law distinctly states that they shall be licensed, and the law is passed, not in the interests of the surveying profession alone. but in the interests of the public generally, and I think there is a little danger of our losing sight of that fact; but there is no doubt that the rights of the profession demand that something should be done in the matter.

Mr. Niven—I would just say in reference to that communication of Mr. Wilkins' that I know of cases where an engineer has made the whole survey of a right-of-way for a railway and got a surveyor to certify to it who never was on the ground. We cannot do anything with those who are not members, but certainly I think no member of our profession should do such a thing as that. Then, with regard to unlicensed persons, we find them in various parts of the country. I know of a case in the County of Hastings, where a surveyor was called in to run some lines, and, owing to the depth of snow, adjourned the line-running until a more convenient season. In the meantime, before that more convenient season arrived, along comes a bush-ranger, who possesses a compass and chain, and he runs all these lines for $2.50 a day; and I have no doubt that that sort of thing is going on in different parts of the province. So that I think the suggestion that we should appoint some one to look after these parties is a very good one.

Mr. Gibson—I think that the simplest way to get at matters of this kind is for each surveyor who knows of a person who is inclined to practise without a license to send a notice to the Secretary at once. And then any surveyor who signs plans in the way Mr. Niven speaks of should have his name reported also, and his attention brought to the fact that he is doing what is wrong and contrary to the law. Probably the best way to get at it is just to frighten them with the majesty of the law. A list should be made of all those who practise in that manner, and also the names of persons who are practising without a license, and should be sent to them, with the warning that in case of their repeating the offence proceedings would be taken.

Mr. Tyrrell—On one occasion, I was asked to sign right-of-way plans for a railway, and I declined positively to sign the plans without having made the survey. I had been doing work for the company up to this time, but when I declined to sign the plans they had no further use for me, and I believe they got some other surveyor to sign them.

Mr. Gibson—They should be warned, and in case of their repeating the offence, they should be prosecuted. There are lots of constables all through these counties who would take the job very quickly.

Mr. Tyrrell—I have had the question raised sometimes as to what is land surveying. Is not laying out a water course, where you have to determine the areas of properties affected, land surveying?

Mr. Gaviller—That comes under the Ditches and Water Courses Act.

Mr. Tyrrell—I think land surveyors should be required to do that work.

Mr. Gaviller—I think we are a little ahead of time in this discussion, considering that this is our first meeting, and we have not even got our by-laws brought up for revision yet I think the gentlemen will be perfectly satisfied that we will appoint a man, and will also be perfectly satisfied as to how he will act.

If I recollect right there was at one time a form sent around by the Crown Lands Department—I remember getting one once —asking us all as surveyors to put down any information as to surveyors in our locality, and also anyone who was practising without a license Why should not we have a form of that kind and send it around to all the members, say once in two years or so, or oftener if necessary, and let them fill it in and send it to the secretary, and he could act on it?

DISCUSSION ON COMPILED PLANS AND SUBDIVISION OF TOWN LOTS.

Mr. Wilkie—There is a matter I wish to speak about: it is in connection with getting up a new plan of the town of Almonte in accordance with the Registry Act. I went before the local Registrar there, asking for information as to how he wanted it done, and he could not give me any information, but he said that the Inspector of Registry Offices wished to see the plan before it was finished: and, as I thought of coming up here, he said if I could bring it with me and show it to the Inspector it would be a good idea. I have done so, and one suggestion that the Inspector has made, and the principal one, is that we change the numbers of the lots: he suggests that we begin with 1 and number the lots continuously throughout the town. As it is now, every man that got a little survey made began with lot No. 1, and numbered as far as his lots went. I don't think there is a number at present above 300, and there are probably 1,500 or more lots in the town. He suggests that we begin at some convenient point, following it out systematically either by blocks or rows, or whatever way would be most convenient. Then, with regard to the difficulty in the abstract of title it can be overcome by furnishing a new set of abstract index books. In carrying it from the old book to the new, he would start off by heading a page lot No. —, Wilkie's Survey of the town of Almonte, and under that he would say Old lot No. —, so that it could be traced back to the original. The Inspector told me that that was being done at present with a map of the town of Picton, and he was endeavouring to have such legislation made on the subject as would enable him to carry out this throughout the different parts of the province, where they chose to adopt it.

Mr. Gaviller—I happened to get into the first law suit I ever got into in my life on that same subject. In the village, in this case, a great many of the lots had never had any original numbers, and the corporation requested me to put numbers on these lots which were not numbered on the plans in the registry office, and in fact to compile these from the descriptions in the deeds. It was the first case of the kind I was on, and I thought my best plan was to submit it to the council, and it was stuck up for months before I was to get any pay. Every man was to look at this to see if he thought it was all right I submitted to this, and they accepted my plan and paid me for it. The next thing, I was summoned to court ; they said my plan was useless. It went on, and was thrown out two or three times. In that case the judge ruled that as far as the numbering was concerned in that plan it had nothing to do with the law, in fact, if the numbers were left out, the plan would have been just as legal, and I consider so myself. As far as numbers were concerned, they were simply put there at the request of the corporation. They threw the case out, and there was an end of it.

Now, as to the Inspector's idea of numbering lots, that is his idea, but what in the world that has to do with the law, as it stands now, I cannot see. It cannot possibly have anything to do with it. The corporation has nothing whatever to do with the sub-division inside ; as far as that is concerned it is simply information given to them which they are supposed to pay for and is given to them by the surveyor ; and when that is put in the registry office it is simply filed, it does not register any lot on that plan which was not formerly registered ; and more than that, it does not nullify any plan that has been in the registry office. The Act calls for the registration of the boundaries.

Mr. Sankey—I am sorry to say I have some experience in matters of this kind. I have been for the last three years trying to prepare a plan of the City of Toronto to comply with the Registry Act and Municipal Act ; and if the legislation outlined by our friend who has just spoken is going to be carried out, I am afraid we will have to pass a very big debenture by-law to pay for the cost of it. I don't suppose anyone has the slightest idea of the number of plans I have to deal with. I am preparing it on a scale of 100 feet to the inch, and if the plans were all numbered on one sheet at that scale, it would be about 35 feet long and 15 feet deep. I don't doubt at all that the idea is a very good one if it will work. As I understand it, the plans that are required under the Registry Act and under the Surveyors' Act of incorporated villages, or even of unincorporated villages, are simply maps on which the various registered plans are compiled all on the same scale ; but that the surveyor who compiles that plan should be held responsible for all measurements, bearings, courses, distances, etc., on that, the same as on a registered plan—it is simply impossible for him to do it. It is not hundreds of plans we have here in Toronto—they are in the thousands now. I have got to go back to the very first plan that was ever registered in the city, and bring it right up to date, and show every plan or sub-division of every plan on that, and surely it is not expected that any one man can be responsible for every measurement on that. All the surveyor can be held responsible for is that he has copied the plans in the Registry Office. Then the difficulty comes in of making them all fit together, and I need not detail the trouble that that alone entails. Then the next difficulty that comes in—and this is one I am not personally quite satisfied as to how it should be treated—is where there is no plan at all. On the compiled plan what are you bound to show? I mean a block inside a corporation of which no registered plan exists other than the plan in the Crown Lands Department. We have several such blocks in the city of Toronto. There are some blocks, considerable blocks too, on which no registration, as far as plans are concerned, has ever taken place; and a person searching the title on that block, until very recently, at any rate, had to go back to the original patent. Every time a block was sold the lawyer, if he did not know the title previously, thought it was his duty to go back to the original plan. In this city the way they have done is this, the Registrar has blocked out the city into certain blocks, and in each block are put all the titles that refer to that particular block, and when a lawyer comes to search a title, he looks that up and takes the Registrar's certificate as true that only certain numbers affect that block, and he need not go into any of the others. That is a point as to which I don't know exactly how far I can make the plan, I am now preparing, satisfy the Registrar; as far as I can, I am perfectly willing to do so; but if in the city of Toronto we are going to re-number all the lots, as the Inspector of Registry Offices suggests, I don't know where it is going to end, and what is going to be law for one part of the province ought to be law for the whole. In smaller places it is probable there are not more than two or three sub-divisions of any one original plan.

I am very glad the subject has been brought up, because I would like surveyors to discuss this matter; and I think if there is going to be an amendment in the Act that the surveyors ought to have a strong word to say as to how this is going to be carried out. Now, in the Registry Act it says, a plan shall be made showing everything registered inside the corporation. Does that mean everything registered inside the corporation, or a survey of everybody's lands who has not had a registered plan? That is where the difficulty occurs. Of course if the Inspector of Registry Offices tells us I want this, that and something else, and the surveyor can get the muncipality to pay for it, I say by all means do what the Inspector asks for. We have a great deal better chance of getting the corporation to pay for it if he says he wants it.

Mr. Chipman—I think this section that is under discussion is capable of a broader interpretation than has been put upon it by the previous speakers. I think this means as it states here, "Where an incorporated city, town, or village, or village not incorporated, comprises different parcels of land owned at the original division thereof by different persons, etc." It strikes me that a surveyor when he is called upon to make a compiled plan of a village is obliged to show upon that plan every sub-division at the time the survey is made whether such sub-divisions were shown on any previous plan or not. I have had some experience in this work, and in one large town two or three sub-divisions were never shown on the plan in the heart of the town. The lots were sold by metes and bounds starting from certain points. I show each of those as a distinct lot, exactly as if they had been surveyed and shown upon plans and filed. I think that is what the Act contemplates.

I don't think it would do at all to number the lots consecutively from the first. It would lead to confusion and considerable unnecessary work in the registry offices and to the surveyor, and would possibly lead to litigation. I am somewhat surprised to hear that the Inspector of Registry Offices has suggested that method of numbering lots.

The President—I think there is perhaps, on the other hand, a great deal of confusion in some towns by lots being numbered, even on the same street, with the same numbers. I know in our town it is so, on the same side of the street. I understood the way the Registrar wished it was, that these lots ought to be numbered consecutively, but that the old numbers certainly would not be abolished. They would have to be retained, for they are in the deeds.

Mr. Wilkie—I understood Mr. Johnston (the Inspector of Registry Offices) to say that it was not necessary to show the old numbers on the plan ; they could be followed back from his proposed system of abstract indexing.

Mr. Chipman—There is nothing in the Act to prevent a man from sub-dividing the city, or town, or village, as the case may be, into blocks, and he can make his blocks conform as nearly as possible to the registered plans filed previously ; or to taking several streets together, so that there will not be two No. 1's or two No. 2's. That appears to be the simplest way to do it.

Mr. Sankey—I would like to ask Mr. Chipman, what has the surveyor got to do to get this information ? Has he got to turn himself into a conveyancer and examine every deed in the Registry Office and find out exactly how it is last held ? At what date is he going to say : This is the final description of this lot. If you have not got them on the registered plans, you have got to go to the deeds, and where is that going to end ?

Mr. Chipman—The day you put your name to the plan.

Mr. Sankey—I don't want for one moment to say that a big city like Toronto should govern the rest of the province, but what I am afraid of, is that the municipalities will not pay for the work of doing this, they will go on and get the Registrar to do it. In Toronto they are dividing up the city into blocks, and if I can make my plan coincide with those blocks I am going to do it, and if I cannot, I am not going to take the responsibility. The Act should be amended to make it clear as to what should be shown on this plan. If a surveyor has got to search all sub-divisions and put them all on a plan, it is a never-ending job I think it would be a very good plan for surveyors to put their heads together and outline some plan as to the matter.

Mr. Kirkpatrick—Would it not be a good idea if this Association could formulate some proposal that could be submitted to the Inspector of Registry Offices? It struck me when Mr. Sankey was speaking, why would it not be possible in this way to exempt the cities in Ontario from the particular features that would be necessary for towns or incorporated villages. As far as the incorporated villages and most of the smaller towns are concerned it would not be so difficult to sub-divide in the way Mr. Wilkie has told us of, but anybody can see that if you take the cities of Hamilton, London, Toronto, or any one of them, there would be no end to the work. If the Association could appoint a committee to just think it over and see if they could formulate some proposal, I should think it is very likely Mr. Johnson would be only too glad to fall in with any practical suggestions; because it certainly is in the interests of the surveyors themselves not to, what they practically call it, kill the goose that lays the golden egg. On the other hand, it is not wanted to make it so cumbrous that it will not be put in force by the different corporations. If there was any good plan suggested, I have no doubt that the Inspector will be able to get legislation in that direction. I don't know myself exactly how it could be done, but there should be special legislation for the cities, or something of that kind, I think.

Mr. Bowman—From what Mr. Wilkie said, I think that the Inspector leaves it optional with the corporation to adopt this new system or not, as they please, and I imagine that only the smaller places would adopt this system of consecutive numbering. That would get over the difficulty of preparing a plan with registered surveys on it, and at the same time a large number of small pieces that have been sold by metes and bounds that have not any number. I know in my first year of actual practice I prepared a plan of the village of Elmira. About half of that had been surveyed and plans filed, and the other part had been sold off by conveyancers with a tape line. Half the plan was taken up with these little chunks, some of them over-lapping each other, but there was no way of telling one from the other. They were simply part of lot No. so and so, in township so and so; and I think that this system would be only adopted in these small towns. I think, however, that the Surveyors' Association might do something in the way of correcting abuses in preparing these compiled plans. The Inspector orders a plan, then the town or village council gets tenders from different surveyors what they will do it for, and they have no more idea when they start how they are going to do it than the man in the moon. I think a good move would be, if new legislation is to be introduced on this subject, to have the renumeration left with the Inspector at so much per day, what he judges the actual time to be put in by the surveyor.

Mr. Niven—I don't think there is any part of surveying that gives more trouble than the compilation of these plans. A number or years ago I compiled a plan of the town of St. Marys. I don't remember now the exact number of registered plans I found there, I think somewhere about 30, and the town council got it into their heads that they wanted a complete map. They advertised for tenders, and my tender was $300 and another one was $200. It took the council a whole year to decide which they would give it to, but finally I got the contract, and I am sure I put $600 worth of work into it, and in the end found it very unsatisfactory. These plans in the first place would not fit together. Then, there were large pieces that they did not cover at all, and I had to make an actual survey of the whole corporation, had to put in the river and Trout Creek that runs through there, and fit in the railways, and had an immense amount of labour over it. It was not satisfactory in the end, and it is not satisfactory to this day, and I think they are now about devising some scheme to get a re-survey of the town. I think if this Association could appoint a committee to look this matter up and make some suggestions in the line that Mr. Kirkpatrick has suggested, that they would be doing a good work.

The President—There is no question at all, there is a great deal of confusion at present in the towns in the country, and the assessors have great difficulty with two or three lots having the same number. There is no question at all, but that if you could get those consecutive numbers it would be the best thing, if it could be done. In the north-west the system is blocks and numbers; block No. so and so, and then the numbers don't run so high.

Mr. Foster—I think the Inspector's idea of consecutive numbering is not a bad one in small places, but in a place such as a town the size of Chatham or London it would be perfectly impossible. I suppose the entry books would be made with two columns, one with the old number and the other with the new one, and it could be easily referred to. But where blocks are laid out by descriptions it would be very different; it would be then very hard to follow. I cannot suggest just now any way of getting over the difficulty entirely, but I think some system of having both the new and the old numbers could be carried out.

DISCUSSION IN REGARD TO FEES CHARGED BY SURVEYORS.

Mr. Dickson—Is there no way of disciplining members of our profession who work below the usual charge? I charge $6 a day in my locality, but I know other surveyors who actually work for $5, though they profess to charge $6. Is there no way of giving these gentlemen a hint that it is unprofessional or unbecoming a member of the profession to bring down the charges for surveying. I don't know if there is any way of reaching them, but if there is, it should be done.

The President—I think there is one clause in the by-laws referring to that; when any surveyor knows of any illegal practice by any surveyor or unlicensed practitioner he is to report it.

Mr. Dickson—I mean licensed practitioners working for less than the regular charge. As I understood it, that point just covered men not licensed. These gentlemen are of the same standing as myself, and they come in and work for improper fees. I think it is very unfair, and should be frowned down. Go to the lawyers and they have their prices, go the doctors and they have all the same prices for attending a person; the surveying profession is the only one I know of that does not.

The President—The draft of the bill presented to the Legislature provided for our charging the usual fees, but it was impossible to get this through the House. The only thing is to discipline the members.

Mr. Niven—Some years ago, we appointed a committee to bring in a tariff of rates in the old Association, and they gave $6 a day as the minimum, and we are supposed to be working under that tariff. Now, as the President has stated, it was proposed to give the Association power to fix their fees by the Act, but Hon. Mr. Hardy advised us, that that Legislation would not pass the House, and we had better strike it out: we could accomplish the same end, by bringing the members under discipline. That is, if this Association will now appoint a committee to bring in a tariff, or adopt a tariff, then every member is in honor bound to observe that tariff, and should he not do so, he could be called to account by this Association. That is how I understand the Act.

Mr. Butler—I don't entirely see how you are going to be able to tell a young man starting out that he shall work for so much or starve. I think every surveyor in the room believes that he should not work for less than the schedule, but still I don't see that you have any right to punish him, if he sees fit for the purpose of making his living to work for somewhat less till he gets a start. Young men cannot be expected to come in on a level with the old men, and I think these things are fixed largely by supply and demand. Other than the expression of the Association against accepting less, I do not see that we have any power, or that we ought to exercise any authority in regard to the matter.

Mr. Winter--It strikes me very plainly that if we are to keep up the standing of the profession at all, it will never do for us to run down the price for which we are working. I can understand very well, that it is not well to overdo a matter of that kind, but before I became a member of this Association at all, I understood what the feeling of the Association was, that the charge should be $6 a day, and I have adopted that for years back, when not a member of the Association at all. And although I did so, I know members of the profession in the western part of the province, that are working for less than $4 a day now. Now, is this sort of thing to go on, when the incorporated Association has made known to the members that it should not be continued? If something is not done, or if this Association does not see fit to exercise its influence in some way to prevent it, I fail to see how we are going to succeed in keeping up the standard of the profession.

Mr. Chipman—This is a vital question, but as a matter of policy I think we had better leave it alone this year. We are only just now incorporated, and to put the thing on the shelf till next session I would move, seconded by Mr. Butler, that the incoming Council be hereby instructed to report upon the question of a minimum tariff at next annual meeting.

Mr. Winter—I would move in amendment that if the matter is taken up by the Association or by the Council of the Association, that in no case shall they fix the fees below what the Act allows the members of the profession for attending court as witnesses.

Mr. Bowman—I have had cases as to that where lawyers look up the Revised Statutes of 1877 and say it is $4, but it has been fixed at $5.

Mr. Winter—I had occasion for a lawyer to look up that question this very day, and after looking it up he paid me $5.

Mr. Morris—There is great danger in fixing a minimum tariff, lest those who charge a higher rate should have it pulled down. Now in my locality I am competing with men who charge $10 a day, In the Association of Quebec they charge $1 an hour and for 10 hours they charge $10. The Ontario Surveyors who hold the Quebec certificate have fixed the rate in that locality at $10 and nothing less; so if you fix a rate it is going to have a bad effect.

Mr. McAree—The fixing of a minimum might have a tendency to hamper those who are charging more. I think, looking at the thing altogether, we had better leave it alone for another year.

Mr. Chipman—We find lawyers commanding their own prices, engineers command prices, perhaps not what is due them, but relative to their attainments anyway, and I think surveyors, if they are to be a profession at all, should stand on the same basis. A man will be paid about what he is worth. I think this matter should be left for the Council to report on at the next meeting, and by that time the members will have thought the matter over. If we now fix a tariff of fees, or a minimum tariff without due consideration, and in a thin meeting like this, we will rouse the opposition, not only of the Legislators and the public generally, but perhaps among the members of our own Association.

(Mr. Chipman's motion was then carried.)

DISCUSSION IN REGARD TO A STANDARD MEASURE.

Mr. Dickson—About the old standard measure, some are of the opinion that if it were possible to get 66 feet steel tapes made and furnished to surveyors, marked with links on one side and feet on the other and stamped, it would be a good thing. They could be kept and only used for the purpose of testing the chain. I don't think there are any of them in existence, but I don't see why they should not be.

Mr. Abrey—Those tapes are already in existence. The Dominion Lands Office have them and I think the price is $8. They are made at Ottawa, under the authority of the Office there, and all Dominion Land Surveyors can get them, and I presume anybody else can too, by simply remitting the price. They are 66 feet long and stamped by the Dominion Government.

Mr. Butler--I am under the impression that we are all liable to be fined for using unstamped chains. I think we are compelled to submit them to the Inland Revenue Office and have them stamped.

Mr. Chipman—Now that we have a testing apparatus in the school of Science, we have the means of testing standard measures. That is under the control of our Provincial Government, and we are under the wing of our Government, and I think it is a good move for the Board of Examiners to furnish standard steel tapes. We have outgrown altogether these pine window sticks that they have sent around to us, furnished with little brass squares on them. I never heard yet of a surveyor comparing his tape with them.

PRESIDENT'S ADDRESS, 1893.

GENTLEMEN OF THE ASSOCIATION OF ONTARIO LAND SURVEYORS:

Permit me in the first place to thank you for the honor you have conferred on me, in electing me as your first President under the Act of Incorporation, and to crave your indulgence for any errors that I may make in filling so responsible a position.

It is my sad duty to refer to the loss which we, as a society, have sustained, through the death of two of our members, viz: Mr. D. S. Campbell, of Mitchell, and Mr. I. L. Bowman, of Berlin; both of whom were honored members of our profession and respected and esteemed members of society. Mr. Campbell was present on the first day of our meeting a year ago, when he was taken suddenly ill and died shortly after reaching his own home.

On behalf of the Association, I welcome those of you who are here for the first time to-day, and trust that year after year our annual gatherings will continue to be not only pleasant, but also profitable, and tend more and more to the elevation of the profession to which we belong. I think we have good reason to congratulate ourselves on the position that we now occupy.

About seven years ago a voluntary Association was formed, composed of a considerable number of the Provincial Land Surveyors of Ontario. In the formation of that Association it was thought that nothing but good could result from interchange of thought between its members, and with that idea in view, annual gatherings were brought about. The proceedings of each of these meetings were embodied in a report and printed, and by means of these we were enabled to make exchanges with similar Associations, both in Canada and the States, and thus to furnish most valuable information to our members, worth many times the small cost of membership. Then there were important amendments in the old "Act respecting Land Surveyors and the Survey of Land" necessary, and through the exertions of that Association, these were obtained; and finally, during the last Session of the Ontario Legislature, with the assistance of the Government and especially of the Commissioner of Crown Lands, the important step in advance was taken, by which we became a corporate body, with powers and responsibilities similar to those enjoyed and assumed by other professions, and it is in that capacity that we meet for the first time in our history to-day.

Now, there is one point regarding this matter that I wish to emphasize, and it is this, that the old Association, recognizing that the legislation asked for, affected, not only those of the profession within, but also those outside, the Association proceeded with the utmost caution in every step taken. It was considered not only advisable, but essential, that there should be no opposition in our own ranks, and with this in view, a copy of the draft of the Bill was sent to every member of the profession, whose address could be obtained, asking his opinion regarding it. The result was practical unanimity, and I believe to-day we start with a body united in its loyalty to what has been done, and prepared to carry out, and not only to carry out, but to assist in working out and perfecting what has been done ; for it must not be assumed, that now, that we have become incorporated, we can rest and be thankful and cease our exertions in behalf of our welfare. On the contrary, we have only obtained a vantage ground which will enable us to do more than was possible heretofore for our advancement.

As you are aware, we have now practical control of the examination of candidates desiring to enter the profession, and it will be our own fault if the standard of admission is not kept sufficiently high to enable us to take rank with the other learned professions of the land. There is another point that might be mentioned, in the legislation that we have obtained, we believe that it will not only be beneficial to us as a body, but that it will be found to be in the public interest as well. On this point, there was, I believe, some misapprehension. It was thought that we were asking the Legislature to grant us powers under our by-laws by which we might profit to the detriment of the community In reply to this, we have only to refer to the Act itself, which certainly gives no such arbitrary powers, either directly or indirectly.

While acting as a voluntary Association, we became affiliated with the Association of Dominion Land Surveyors. I am happy to say that our relations with that body have always been most cordial, as certainly becomes two bodies so closely related, and I trust that in the future the same harmony may always continue.

It has occurred to me, that we might profitably reciprocate still further with our sister Associations, by inviting each one to send a representative to visit us at our annual gatherings and to be a guest at our dinner. This is not an uncommon practice with other societies, and I am confident that it would add very much to the interest of our meetings if we could have with us professional brethren from other fields than our own, and I presume that they would be quite willing for us to send representatives to their meetings, and the reports of the latter would also be interesting and profitable to us.

In addition to the ordinary business you will have at this session the ratification of by-laws, in accordance with the provisions of the Act. Other matters necessitated by the change in our status will require your attention, and, in view of this, I feel that I would be trespassing on your time by detaining you longer ; but I cannot close without expressing a hope that our deliberations may be conducted in the same spirit in the future that they have been in the past While we have had many discussions where difference of opinion was entertained and expressed, yet during all those years I do not recollect any member ever violating the amenities of debate, or being called to order by the chair.

In this respect I feel like challenging any body of men, either lay or clerical, to show such a record, and with such an example I shall feel that if there unhappily should in the present session be a departure from it, it will have to be attributed to your presiding officer.

I will now, gentlemen, ask your attention to the various subjects on the order paper.

I thank you, gentlemen. for the kindness you have shewn me, while I have been presiding over this meeting. There is just one little matter that I think in the future, perhaps, we might attend to and it would expedite business very much, that is, that all motions be written out and handed in before being put. I know it would save a good deal of trouble. There has been no change, I am happy to say, in the cordial relations that have subsisted in the past between us. As I said in my address, I don't think there is any other body that can shew such a record as we have shewn. We have never had any discord whatever, either in committee meetings, so far as I know, or in open session, and I am very glad to know that this meeting has been no exception to the rule, and I hope concord may continue in the future.

PAPERS.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

GEOGRAPHICAL SURVEYING.

By L. B. STEWART,

O. L. S., D. T. S., Toronto.

DURING the past summer I was one of a party of five that made an exploratory trip through that portion of the Rocky Mountains lying between the Bow and Athabasca rivers. Although our chief business was pleasure, each member of the party undertook some special work, so that we might bring back some results worth preserving. Two undertook to look after the geology of the country passed through, and another agreed to act as photographer, while I took upon myself the duties of topographer. We expected to travel at the rate of fifteen or twenty miles per day, so I set to work to devise some means of making a rapid survey of our route, unaided, at that rate. Doubtless many surveys of the sort have been made in a systematic manner, but very few making such surveys, I think, have committed their methods to writing, so that others may have the benefit of their experience; at least I was unable to lay my hands on anything that was of any service to me. I resolved, therefore, to adopt the following method:—I provided myself with a prismatic compass, a pedometer, and a sextant and artificial horizon; the pedometer to be used in making a rough traverse of our route, and the sextant in determining time, latitude and azimuth. The distance given by the pedometer would of course be greatly in excess of the straight line distance between two points, but the ratio between the two would be pretty nearly constant, and a plot of a traverse joining two points at a moderate distance apart would give the direction of the line joining those points with considerable accuracy, though its length might be greatly in error. The determination of the latitudes of the two points, however, would serve to correct the distance, as long as the line did not make too large an angle with the meridian. The pedometer was adjusted to my pace before leaving Toronto, though I did not expect that adjustment to hold good for distances along an Indian pack trail.

On July 8th we left Morley, a point on the C. P. R. forty miles west of Calgary, and for the first few days kept among the foot-hills. On reaching the Red Deer river we followed that stream for some distance, entering the mountains, passed the forks of the river, and kept to the north-westerly branch for about twenty miles. We then left the Red Deer and struck across a height of land and reached the Clearwater. I found the method of survey admirably adapted to the country through which we travelled, the valleys of the rivers extending in long, straight stretches for many miles, so that sometimes it was only necessary to read the pedometer at the beginning and end of a day's march, and to take the general bearing of the valley through which we had come, while at other times it was necessary to take bearings every mile or two from one rise to another over which the trail passed. The bearings could best be taken backwards, as it was easier to tell the direction from which we had come than that which the trail was going to take in advance of us. Bearings were taken also to prominent mountain peaks, which served both to locate those points and also as checks on the general traverse. The topography was also sketched in detail.

Observations for latitude and time were taken whenever possible; where neither of these was known I found a good method to be as follows:—At noon a number of altitudes of the sun were measured, and the time noted, and also the greatest altitude for latitude, and towards evening a number more were taken for time. A value of the latitude was found from the maximum altitude, which was used in the reduction of the time observations, thus finding the watch correction. The circum-meridian altitudes were then reduced, employing the corrected times, thus finding a value of the latitudes from each. I preferred to reduce each altitude separately to taking the mean of the altitudes and the mean of the times, as any one altitude giving a result differing widely from the others could then be rejected in taking the mean. In the case of the circum-meridian altitudes it would not be correct to combine several by taking their mean before reducing After having determined the latitude and the watch correction, the variation of the compass was easily found by taking a number of bearings of the sun, noting the times; then the latitude and declination being known each observation gives a value of the azimuth, which, compared with magnetic azimuth, gives the variation. This method, it is true, involves a good deal of calculation, but this can be left to some future time; the present and not the future is to be considered in such field operations. The following are the results of a set of observations taken at one camp:—

CAMP 28 (APPROX. LONG. = 7 h. 45 m.)

Sept. 4, 1892.

2—alt. $\overline{\odot}$	Watch time.	Latitude.
90° 12′ 50″	12 h. 28 m. 40 s.	51° 56′ 38″
14 0	30 18	56 40
14 30	31 28	56 47
15 50 (max.)		56 46

Mean = 51° 56′ 43″

Index Error = + 35″
Watch corr'n = − 37 m. 40 s.

Sept. 5.

2—alt. $\overline{\underset{\smile}{\odot}}$	Watch time.	Corr'n.
32° 49′ 20″	7 h. 47 m. 32 s. A. M.	– 37 m. 31.9 s. (?)
33 16 40	" 49 2	37 37.2
33 36 40	" 50 10	37 39.2
34 7 10	" 51 52	37 41.3
34 26 50	" 52 58	37 41.3
		Mean = – 37 m. 39.7 s.

Watch time.	Mag. Az.	Ast. Az.	Variation.
8 h. 8 m. A. M	80°.2	104°.6	24°.4 E
8 h. 9 m. 20 s. "	80°.5	104°.9	24°.4
8 h. 11 m. 50 s. "	80°.7	105°.3	24°.6
			Mean = 24°.47 E

The method given above of course cannot be used where it is inconvenient for the explorer to stop during the day to observe. For night observations he may proceed as follows:—Measure a number of altitudes of Polaris and also of some other star or stars near the prime vertical, noting the watch times. If the pole star is not far from its elongation any one of the altitudes may be used as the latitude in the reduction of the observations of the time stars, and the watch correction thus determined—if near the prime vertical the error resulting from an incorrect latitude is very small The times of the pole star observations are then corrected, and form each a value of the latitude deduced. If the mean of the values so found differs much from the assumed value it may be necessary to reduce the time observations afresh, and then find the effect of the alteration in the watch correction on the latitude. This may be done conveniently by the differential formulæ :—

$$dt = -\frac{d\rho}{\cos\phi\tan A}$$

$$d\phi = -\cos\phi\tan A . dt$$

in which

$d\phi =$ the correction to the latitude.

$dt =$ the correction to the hour angle reckoned east or west from the meridian.

$\phi =$ the latitude.

$A =$ the azimuth.

In the first formula of course A is the azimuth of the time star, and in the second that of Polaris.

I was obliged to take my observations during the day, being provided with a glass horizon, which, being levelled by means of a small spirit level laid on its surface, had to be watched continually to guard against a change of inclination; with a mercury horizon this difficulty is obviated.

After reaching the Clearwater our trail followed that river for about twenty miles and then struck over a height of land about 7,000 feet above sea level, and a few miles further we reached a stream flowing into the Saskatchewan, which we reached on July 18. We then crossed the Saskatchewan and followed it down stream till we were among the foot-hills again; we then turned sharply to the left and travelled in a north-westerly direction through a country distinguished by its numerous swamps, muskegs, and mosquitoes, till the Brazeau river was reached. We now re-entered the mountains, keeping to the Brazeau, which we explored nearly to its source. About thirty miles above where it leaves the mountain the river forks, the more northerly branch flowing from a lake of considerable size, which we named Brazeau Lake, as it was not shown on our maps. From this lake we crossed a height of land and soon reached a small stream flowing north-west, and we concluded that we had crossed the divide between the Saskatchewan and the Athabasca systems. This stream led us finally to a large river which the Indians call the Sūn Wapta, and which is probably the Athabasca. After following this stream for about twenty miles our trail became impassable, so we carried on our explorations on foot about fifty miles further and penetrated to a large lake, in latitude about 52.° 18′ N., that discharged towards the west, and which therefore must be situated at or near the summit of the Rockies. Provisions now began to run low, so we were obliged to beat a retreat, and by forced marches reached Morley in ten days, after an absence from there of two months and two days.

I have given merely a hurried account of the trip as there was little to distinguish it from similar expeditions through a mountainous country. We had two Stoney Indian guides, who required the usual amount of humouring to keep them from deserting us.

During the progress of the trip the courses of the rivers were sketched from some convenient height, and rough surveys of the lakes were made in the following manner: Having climbed to some point at as great an elevation as possible that commanded a view of the whole shore line, the height above the lake was determined by means of the barometer, and then compass bearings were taken to prominent points along the shore and the angles of depression of those points measured with a clinometer level, thus fixing completely the positions of those points with reference to the station point. In this way a tolerably accurate survey of a lake ten miles in length may be made in about fifteen minutes after having reached the station point, and with more accurate instruments the method is susceptible of a considerable degree of accuracy.

On my return to Toronto I found myself in possession of quite a mass of notes and observations, from which I proceeded to construct a map. I first plotted in the Polyconic projection the meridians and parallels of the region traversed, and then fixed the position of the starting point from a reliable source. I then plotted the traverse of the route beginning at that point, reducing the pedometer distances by one-third and correcting the bearings for variation until the first point whose latitude had been determined was reached. A straight line was then drawn connecting the extreme points of the traverse, and the parallel of latitude of the terminal point, found by observation, also drawn; the point of intersection of these two lines fixed the true position of the terminal point. This method was continued until the whole was plotted. I found the mean value of the ratio of the straight line to the pedometer distance to be about six-tenths. After the traverse line was plotted and corrected the topography was added.

It is readily conceded that the method described above is only applicable under certain conditions. The nearer the general course comes to being due north or south the better the check the latitude is on the distance, but if the direction be nearly east or west the method fails altogether. In the latter case it would be necessary to depend upon longitude determinations, and these are acknowledged to be rather unsatisfactory with portable instruments. A good lunar observation would give the longitude to within five or six miles, and this does not compare with a latitude determination with the same instruments, and chronometers are too delicate to be of any use on a rough expedition. The following method might be used to advantage when the party intends to return by the same route:—Let each member of the party be provided with a good watch, whose correction is found at the starting point before leaving and also on returning, and let their corrections be also found at as many intermediate points as possible along the route on the way out, and also at the same points on the return trip; a comparison of the two corrections found at any one point together with the interval of time between them will give a value of the watch rate, and a value of the rate can be thus found from each pair of observations, and an idea of its regularity in this way gained. The watch that shows the greatest uniformity in its rate may be used in comparing the local times of the initial and terminal points, and also those of the intermediate points.

By some system such as I have outlined here a survey of a large extent of country sufficiently accurate for a great many purposes might be made in a very short time, and throughout large sections of the Rocky Mountains land will never be valuable enough to justify a more accurate survey.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

HISTORY OF THE TACHÉ GOLD FIELD.

By HENRY DeQ. SEWELL,

O.L.S., A.M.I.C.E., ENG., D.L.S., Port Arthur.

THIS promising gold field was first discovered during the construction of the Canadian Pacific Railway, in the year 1882, by a Mr. Baby, who found a very promising vein on the north side of the railway track, and early in the year following several good-looking veins were located by the author, Mr. Halstead, and several others. All the locations being situated about 4 miles east of Taché Station, or 177 miles from Port Arthur, or 121 miles from Rat Portage, the first place where gold was found in Western Ontario (in which place it was discovered a few months previously).

Unfortunately for Taché, it has no inhabitants other than the few employees of the Canadian Pacific Railway, Taché being only a small side station, whereas Rat Portage is an important division station, with considerable lake traffic, and consequently it has a population of several thousands. It is, therefore, not to be wondered at that whilst the richness of the "Lake of the Woods" or "Rat Portage" gold field, has been prominently and persistently kept before the public, the claims of the rich but comparatively unknown Taché Gold Field, with a very limited number of persons interested in its development, has easily been kept almost a profound secret, until it has suited the purposes of the few, who all along were acquainted with its wonderfully large and profitable veins, and which compare most favourably with the better known, but more refractory gold ores of the Lake of the Woods, to say nothing of the more advantageous position for shipping by rail of the Taché gold field. The Lake of the Woods ores having to be shipped by steamboat prior to being transhipped by rail.

After the discovery of the first claims and their subsequent location, nothing was done towards their development, beyond a small amount of stripping on some of the veins, until the summer of 1889, when the "Maple Leaf Gold Mining Co." commenced operations on the "Wawbeek" (one of the original finds) under the able management of Mr. S. V. Halstead, who commenced operations by sinking at the junction of two veins, with the satisfactory result of the assay value increasing from $2.00 gold at the surface to $15.00 gold at a depth of 12ft., the vein being about 2' to 4' in width, the quartz being of a greyish white colour, carrying iron pyrites; when work was suspended owing to water coming into the shaft.

The company having been organized as a development and exploring company, and having carried on an extensive exploration of the surrounding country, whilst mining on the "Wawbeek" were fortunate in discovering the "Black Fox" situated about 2 miles further east, or 175 miles from Port Arthur. The company have sunk two shafts on the main vein, and did some stripping of the vein, the work coming to an end about Christmas of the same year, after which all work was suspended pending an attempted sale of the property, the capital of the company being insufficient for anything beyond preliminary exploration. In the summer of 1892, however, the company was reorganized with a larger capital, under the name of the "Taché Gold Mining Company" and the "Jumbo" and "Dolina" claims, which are adjoining the "Black Fox" have been added to the company's property, thus providing for mining operations an exceedingly strong vein, varying from thirty to one hundred feet in width and averaging at least from forty to fifty feet in length, which extends throughout the "Black Fox" and "Jumbo" locations for a length of over four thousand feet, although it is capped over with soil and trap in places. The gangue of the vein consists of a very fine grained flour quartz. On the surface in some places it is somewhat discoloured from exposure, but its natural colour appears to be almost a pure white. The gold contained in the ore is extremely fine, so much so that but little mineral can be seen with a magnifying glass. The average of six assays taken indiscriminately from the vein amounts to $7.15 of gold and silver, mostly gold—some of these assays showing no silver. The walls of the vein are clear and well defined and the vein runs with the formation, which consists of Huronian blue trap, at an angle a little north of west and south of east. The vein dips 10 to 20 to the north, and shows a strong tendency to widen out as it goes down. There are also two very nice looking veins on the "Dolina," as shown on my plan, that are well worth prospecting with every probability of their turning out valuable.

The property is very advantageously situated, being about six miles east of Taché Station, on the Canadian Pacific Railway, and about half a mile south of the track, from which a spur or side track could easily be constructed to the Minne-ha-ha River, a rapid running stream about seventy feet wide, which flows through the "Dolina," and on which location there is a nice waterfall of over twenty feet that is capable of supplying considerable power for at least half the year.

The enormous quantity of ore in sight, and the ease and cheapness with which it can be literally quarried is so great, that the author considers that it could be crushed and handled very economically on the ground, for which purpose he has recommended the erection of a ten stamp mill of the latest and most approved style of seven hundred and fifty pounds per stamp, with engine and boiler, automatic feeder, breaker, two electric plates, two pulverizers and blankets over sixteen inch sluice to catch the concentrates, and with ample provision for the addition of an extra ten stamps, which could be erected and put up on the ground, say close to the waterfall, for $13,000, and the additional ten stamps, with accessories, would cost an extra $6,000, erected on the ground when required. Such a plant, which is similar to those used generally throughout the United States, should save from 95 per cent. to 98 per cent. of the mineral contained in the ore, and as such ought to commend itself in preference to the many new-fangled experiments which are constantly being offered to the public.

The author has also proposed the sinking of a shaft in pit No. 2 to a depth of fifty or sixty feet to meet a drift run in simultaneously from the foot of the hill along the course of the vein, which should be done within a length of two hundred to two hundred and fifty feet, which procedure would open up a large body of ore sufficient to meet all the mining requirements for several years to come, besides affording ample drainage for the mine, after which the author considers that the ore could be mined at a cost not exceeding 25 cents per ton, and taken on a tramway with a down grade to the mill at the falls, where it could be treated for fifty cents a ton, thus costing 75 cents per ton for milling and treating. On this basis a ten stamp mill working, say, three hundred days per annum and crushing twenty tons a day, would crush annually six thousand tons, worth, say, seven dollars per ton, would yield $42,000 less, say, $5,000, as cost of mining and milling equals $37,000, and with an additional ten stamps, this yield would be doubled. Of course this is contingent on the assumption that the ore does not increase in richness as it goes down (a very improbable event). Also to this estimate would have to be added the cost of superintendence and contingencies, which would be the same in any event, together with the interest on capital; but from this it can be easily seen that the annual yield, even under the most adverse circumstances, would be so large as not only to cover the contingent expenses, but to leave very handsome dividends.

In addition to the development work by the "Taché Gold Mining Co.," a very important discovery, called the "Mastodon," has been made about four miles west of Taché Station and about two miles south of the railway, which the author surveyed for Mr. Arthur, of Detroit, and Mr. Halstead. The property consists of two wide veins about three-quarters of a mile apart, varying from about 50ft. to 130ft. in width. Development work is being vigorously carried on under the supervision of Mr. Halstead, with the object of placing the property on the English market during the coming summer. The formation here differs entirely from the properties of the "Taché Gold Mining Co." and all previous discoveries in that locality, where the veins run through the Huronian Blue Trap and Slates, whilst at the "Mastodon" the veins are entirely in the Huronian Talco Schist formation. The veins are composed chiefly of white quartz with streaks of mineral containing a large percentage of copper, banded with vertical seams of Talco Schist, which latter decreases considerably as the shaft goes down, giving place to the quartz.

After some surface blasting, with the view of discovering the most favourable spot for sinking a shaft, a place was selected where the vein is about 90 feet in width, at a point a little north of the centre of the lode or vein, where a shaft has been sunk 7'x5', work being commenced on the 1st November last. The shaft is at present 40 feet deep, the vein showing so far no appreciable dip, the course of the vein being about 10° north of east. The streaks or seams of quartz average about five inches apart going in and out in a wavy manner, but keeping a straight course down, becoming thicker as depth is attained. The mineral has thus far seemed equally divided between the quartz and Talco Schist, though the iron pyrites are chiefly contained in the latter. There are also two seams carrying sulphide and copper pyrites containing gold, and are about four inches wide, narrowing and widening in places from two to ten inches, which also keep a straight course down, but twisting in and out; the two streaks being about four to five feet apart. At 35 feet down silver began to suddenly increase, taking the form of small nuggets, a very remarkable feature in a gold mine. At 38 feet down a third, though very narrow, similar streak of sulphide and copper pyrites has begun about the centre of the shaft and is increasing in width with depth.

At a depth of 40ft. the vein has been cross cut on each side of the shaft to ascertain the true width of the vein, which has thus been proved to be 28 feet wide, although from surface indications it appears probable that there may be one or more parallel veins in the lode; but be this as it may, the present ascertained width, is ample for very extensive mining operations. The main streak which occurs in the centre of the vein is 12ft. wide, and is composed principally of quartz; between that and the side walls are streaks 8ft. wide on either side. These side streaks are both highly mineralized, and are composed of mica schist full of numerous quartz stringers. The work of sinking is being carried on as fast as possible, the quartz constantly increasing in width, and the mica schist decreasing as the work goes down on the vein. The average assays at the surface were $3.00 per ton, ($2.00 gold and $1.00 silver); at 12 feet the average assay was gold $6.00, copper $8.00, total $14.00, the gold being evenly distributed, and the copper being confined to the seams, carrying sulphide and copper pyrites already described. At 30 feet, gave gold (average) $44.50, copper (from the streak) $48.87, silver 83c., and platinum a trace, total value $94.20 per ton; an increase from the surface of $91.20, and of $80.20 from the depth of 12 feet.

The general features of the country surrounding Taché would seem to indicate, that it has been subjected to great denudation during the glacial period, the country being exceedingly flat for a mineral district, and what few rocks are to be seen, are mostly low and surrounded with swamps or muskegs. Consequently it is very difficult to discover and follow up the different mineral veins in that country, and hence it is not surprising, that only a very few really good veins have so far been discovered. Generally speaking, the best veins appear to lie to the south of the railway; those found to the north of the railway being mostly north and south veins, whilst those south of the railway, are chiefly east and west veins, and generally of a greater width. There is also in the neighbourhood of Taché a very decided change of formation. From east of the "Black Fox" to about 3 miles east of Taché Station, the formation consists of Huronian Blue Trap and Slates, where a narrow belt, running about north and south, and varying from one to two miles in width, of Laurentian Gneiss, that almost approaches to granite in appearance, comes in. This formation is followed again by the Huronian Blue Trap and Slate, which extends westward to the north of the railway, and also to about two miles south of it, where the Huronian Talco Schists comes in. It will thus be seen that the country surrounding Taché is peculiarly interesting from a geological and mining standpoint, and presents a rich field for both the miner and geologist, and one which will amply repay the careful examiner, for his labor and trouble in exploring this interesting country.

In conclusion, the author wishes to say that in the foregoing pages, he has attempted to present a short account of the mineral resources of a comparatively limited and unknown district. His remarks on the extreme difficulty in giving publicity, to the mineral resources of Taché applies with equal force to many other comparatively unknown and unvisited mineral belts, which cross and recross at intervals in near proximity to our great Canadian highway, the Canadian Pacific Railway, many of which would richly reward the patient miner, and the aristocratic geologist, in their search for mineral wealth, and geological formations ; and would also tend largely to produce the early development of our vast mineral wealth, and add greatly to the prosperity of our beloved country.

DISCUSSION.

Mr. McAree—I have never been so far west as Tache, except passing through on the C. P. R. One thing I thought was very encouraging, was the width of the veins. When you get a vein as wide as those that Mr. Sewell has described, carrying $6 or $7 a ton, it is a very rich yield.

The President—The question struck me whether it was not too wide for a well defined vein. Then again he spoke of it running with the formation ; is that a good indication ?

Mr. Sewell—Yes, I consider that is one of the best indications.

The President—I thought a fissure vein crossed the formation.

Mr. Sewell—Some of them do, but not necessarily.

Mr. McAree—I would ask if these widths that he gave include any country rock ?

Mr. Sewell—There is sometimes a little in them.

The President—I don't know whether any gentleman here knows anything about this wonderful Ophir mine—that is a mine near Thessalon. I heard wonderful reports about it the other day. I heard that there was a pyramid being sent to the Mineral Exhibit at Chicago that would astonish the world.

Mr. McAree—I would like to ask about the dip of the vein ?

Mr. Sewell—About 10° to 20° from the vertical.

Mr. McAree—Are the wall rocks the same on either side?

Mr. Sewell—Yes.

Mr. Whitson—Is there not some difficulty in getting practical mining men to interest themselves in veins that would yield as low as $6 or $7 a ton? In my experience mining men care very little about going into a vein unless it averages $20 a ton. Take a vein 2 feet wide, it is quite a common thing to get quartz yielding $15 or $20, and mining men won't look at it at all.

Mr. Sewell—I don't think there is any difficulty where you get enough of it. If you have 30 or 40 feet it makes a great deal of difference: you can get it out easy and there is less expense in excavation.

Mr. Ledyard—Perhaps you might like to hear about some very low grade ores that have paid high dividends. I can give you a few that are working on a very large scale. The Homestake mine in the Black Hills yields $3.79 in gold, and after reducing, it leaves a profit of $1.19 per ton. It is only made to pay in that way by being worked very largely. Nearly a quarter of a million tons are treated per annum. Similar results in a small way have not proved satisfactory. Then there is another with a still lower yield, the Treadwell gold mine in Alaska. The second annual report for the year ending May 31st, 1892, shows a profit of $361,000 earned during the year. 239,633 tons were mined, yielding $707,000,—an average of $2.95 per ton only. The total mining cost was 64 cents per ton; wages of drillers and labourers were high, and blacksmiths were $4 and $5 a day, but notwithstanding this the total milling cost was 38 cents per ton; the total operating and reduction cost was $1.50 per ton. Haile gold mine, Lancaster Co., South Carolina, yields only about $4,50 a ton. They are working now, I believe, about 120 tons a day. They were working 80 tons a day and made it pay very handsomely. I think the Alaska Treadwell mine has gone down to a steady width of 45 feet.

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TIMBER SURVEYS AND EXPLORATIONS.

By J. F. WHITSON,

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In this paper I desire merely to say something that may be of some practical benefit to the younger members of this Association who have not had any experience in this kind of work. As early as 1830 the survey and licensing of timber berths was begun by the Government on the Lower Ottawa. The system as then introduced was to lay out the timber in large blocks, occasionally very irregular in shape, having a frontage on the Ottawa River of various lengths, and running back a distance of from five to ten miles, the rear boundary being parallel to the general course of the water front, or midway between two streams. This system was continued up the Ottawa River as far as Lake Temiscamingue and westward to Lake Nipissing, and extending inland on either side of most of the larger tributaries; in fact, covered the greater portion of the Ottawa valley. In 1857, base lines were commenced north of Lake Nipissing and extended westward through Algoma. These lines formed the basis of a new system of township surveys, six miles square, which were sold as timber berths; the same surveys serving for both township and limit outlines. Large townships in the Huron and Ottawa districts that were sub-divided before the timber was disposed of, were divided into several blocks and sold as limits, the lot lines forming the boundaries of the different limits.

The old system of laying out timber along the different streams was an excellent one, but the block system, especially when large, has in many instances proved unsatisfactory to the lumbermen. Though it is not my intention here to suggest any improvement relative to the different systems, yet the assumption is that it might be more profitable to the Timber Department, and more satisfactory to those who purchase limits, owing to the rapid increase in the value of pine and other timber, if the unsurveyed sections of Northern Ontario, before being laid out in limits, were thoroughly explored by good practical lumbermen or surveyors, who have a practical knowledge of timber, and sketches furnished shewing the position of the lakes, streams, watersheds and all valuable timber, and the position of the most suitable boundaries of the different limits projected thereon; so as not to include, where practicable, on limit "No. A" for example, timber tributary to streams flowing through an adjoining limit and in an opposite direction from those flowing through the former. This was the system adopted in the survey of limits in the District of Rainy River. A thorough exploration of the country was made in advance of the survey by thoroughly practical lumbermen, who examined carefully the position of the pine, lakes, rivers and water-divides, and furnished the surveyor from time to time, as the work proceeded, with sketches of the different sections explored, showing the position of all lakes, rivers, blocks of timber, etc., with the proposed outlines of the different limits projected thereon, leaving prominent marks along the streams or lakes where they should begin and end. Occasionally there is considerable trouble in locating the rear boundaries along the height of land, but by running trial lines this difficulty will be overcome, and in the end it will be found time profitably spent.

Each explorer should be accompanied by a good bush-man, who travels with him continually, besides other assistants necessary to keep his camp outfit and supplies near the work. One of those assistants should be able to cook The camp outfit should be light yet comfortable. He should be provided with a large pocket compass, a field glass, a pair of climbers and a pedometer for estimating distances travelled. After exploring a section he should forward by his assistant his sketches, shewing all information that might be of assistance to the surveyor, who would retain the explorer's assistant as a guide while surveying that section, and return to the explorer one of his most intelligent axemen in exchange.

If estimators accompany the survey party they should each be accompanied by a good man, besides other necesary assistants to keep their camp outfit and supplies as near their work as possible. They should be each furnished with a tracing of the limit to be estimated, shewing, wherever possible, the area of the different parcels covered with pine, and where the limit is large and not divided by lakes or streams, cheap division lines should be run, dividing the limit into blocks of a reasonable size to suit the estimators, and the area placed on each block. Where the timber is unevenly distributed, the smaller those divisions the more accurate can the estimate be made, as the customary way of estimating is to first carefully travel each block of timber and then select an average acre, or part of an acre, in different parts of the block, estimate those carefully by counting the trees and estimating approximately the quantity in each tree, and by this means strike an average per acre of the whole block. From this it will be seen how important it is to have the areas placed on each block, as many an estimate has been incorrectly made, owing to the lack of information which should be supplied from the surveys. The writer is of the opinion that most men not accustomed to surveying, and even practical lumbermen, are apt to overestimate the area of small scattering groves of timber. All the information that can be procured from the survey, as well as from the exploration, should be furnished the estimators. If they accompany the surveyor much valuable assistance can be rendered them.

The plans of the survey are generally made on a scale of forty chains to the inch. All lakes and large streams within the limit should be traversed and shown on the plan. The astronomical course and length of all boundaries, a description of all posts planted and how marked, the outlines and description of the different blocks of timber ; in fact, all information that might be of value to either the seller or buyer should be shown on the plans. On floatable streams be careful to note rapids, falls, or other obstructions.

It is of the first importance before starting on any survey to secure a good party, as on their exertions and to their intelligence depend a great deal the rapidity of your movements and the success of the expedition. The instruments I found most satisfactory and convenient for such work were : the solar compass ; Foster's improved micrometer, with base rod fifteen to twenty links long, with white porcelain discs for summer use and stained glass for winter ; a heavy steel tape ; a light compass, with four inch needle ; a link chain ; a folding drawing-table, and other necessary drawing material and instruments (do not take liquid ink for winter use.) The party should consist of the surveyor, a good assistant, who, besides being a chain man, should be able to take charge of the survey when required, a good cook with experience on similar expeditions, five or more good axemen, the more depending upon the number required in forwarding supplies.

If the survey is to be carried on in the summer season all of the party should be canoe men, if in the winter they should be able to snowshoe, pull a toboggan or drive a dog team. As the necessary camp outfit and supplies for a timber survey carried on in the summer is similar to that required in subdividing a township, and was very fully described by Mr. Burke in a paper read before this Association last year, I will therefore confine my remarks chiefly to the requirements of a winter outfit for a party of eight, the survey being remote from civilization in the northern districts of Ontario. Secure three square tents made of eight oz. duck or xxx, two of them 8'x10', the other 10'x12', with a two-foot wall ; three stoves made of light Russian iron 20"x12"x11", with five feet of pipe for each stove, made so that one length can be slid inside another and all packed inside the stove. The pipes should be about three inches in diameter and each set supplied with a damper. Folding stoves, though more convenient to portage, do not give as good satisfaction. Two heavy double blankets for each man, and if possible each couple of men should secure a rabbit skin blanket, as there is more comfort in one of them than in two woollen ones of double the weight, and without your men are made comfortable you will have no end of trouble through sickness, or men deserting you. A folding reflector and two light sheet-iron bake kettles, beside the other usual cooking utensils.

If the survey extends over a large tract of country, where much moving about is required, procure two good dog trains (six dogs in all) and two large toboggans, eight feet long by fourteen inches wide, made of well-seasoned white oak or beech, made in two pieces of equal width, for if made of one board they become high in the centre and are apt to slide off the trail. Smaller toboggans, six feet in length, should be supplied to each couple of men, except the cook, whose work when moving camp begins when the others end. Three good dogs will draw from 300 to 450 pounds fifteen to thirty-five miles per day, depending upon the condition of the trail. They are fed once a day, after their day's work is done, and will consume on an average per day a little over one pound of corn meal and a-third of a pound of tallow per dog; if fed on fish three pounds per day, but will not work so well on the latter as on the former. The dogs should be all chained up at night, as no matter how well they are fed they like a dessert of snowshoes, or poke their nose into the cook's affairs. On one occasion, while camped at Pine Portage on the Dawson route, the Hudson Bay Company's dogs unearthed the bean kettle from the hot ashes and were in the act of pawing off the cover when the cook arrived with his shovel. Each member of the party should provide himself with a pair of good snowshoes and sufficient showshoe filling for repairs during the expedition, three pairs of moose or caribou moccasins and a pair of seal moccasins for use during the soft weather in the spring, a pair of smoked glasses and some sulphate of zinc to prevent snow blindness during the latter part of February and March.

As to provisions, men will consume about one tenth more in winter than in summer. It would be well to calculate on 1¼ pounds of flour, 1¼ pounds of bacon, and one-half pound of beans, besides the usual allowance of tea, sugar, evaporated apples, etc., for each man per day.

DISCUSSION.

Mr. Dickson—I have been a great deal out in the winter season, and I have never had any experience with stoves at all. Mr. Whitson says that each man requires two pairs of blankets; but I was out all last December and up to the 22nd of January, and I had no stove in my camp. I had a rabbit-skin blanket for myself and one pair of blankets under, and the other two men had three pairs between them, and I found that quite sufficient. Of course there is a great difference in men. If they have stoves in their tent, I suppose they would do with a good deal less. But I have no doubt Mr. Whitson speaks from practical experience. With regard to provisions, I find it very difficult to say what quantity of provisions to take. I sometimes take two or three men out and find myself run short, and then take two or three different men and the same quantity of provisions and have three or four days' rations left. With regard to getting good men, I cordially agree with him that the very best man is the cheapest; and above all you want a first-class cook, no matter what he costs. The provisions must be well cooked, and the utensils must be taken care of. I have had cooks that within a fortnight ruined a set of utensils altogether that would do other cooks six months, or perhaps two years. With regard to tents, I find that common double-twilled cotton is just as good as any heavy duck you can get, and much easier carried round.

The President—There is one point there that is worthy of attention, that is regarding the division of the limits so as to correspond with the water sheds. It is very important, indeed, that these limits when they are sold should be on the same water shed as much as possible.

The President—With regard to what Mr. Dickson says about stoves, my experience is that for the sake of fuel alone it pays to take a stove.

Mr. Dickson—I think if ever I am out over winter again I shall try and get a stove just for that very reason. I have never suffered from cold, but I am satisfied it would save a very large amount of labour to have stoves.

The President—Some years ago I made a trip from Rainy River to Prince Arthur's Landing, and I had stoves. We started through in the fall, and it took us until January to get to the Lake of the Woods. We met another party who had not stoves; they had a big log-heap and a big fire on, but they were nearly frozen that night. The man in charge told me he would not have stoves, and advised me to throw them away, but the man who was with me said he would turn back if I threw them away.

Mr. Morris—I have used them and found them very useful. They are made so as to fold up, and put together with pins along the side, and I think they weigh about six or eight pounds. The pipes fold together, and the whole thing takes up very little room.

Mr. Sewell—I have always found in my experience it is far better to have shed tents and a log-heap. I have tried the stoves, tried everything, and I believe in nothing but just simply having a nice sheltered tent made out of light cotton, as light as possible. It is best to put them up in pairs, one facing the other, with your log fire in the centre, something on the principle of the Indian wigwam, and I don't think there is anything so comfortable as that.

Mr. Kirkpatrick—My experience is this, the more comfortable you can make yourself on a winter survey the better work you will do, and the better you feed your men the better work they will do. I thoroughly believe in making yourself comfortable with stoves. I have been out in winter, on the north shore of Lake Superior, with the thermometer 35 degrees below zero, and we were always just as comfortable as anything, and we never had those beautiful inventions of now-a-days, rabbit-skin blankets. But I remember Mr. Pearce, who is one of those who do not care much for comfort, spent a whole winter in Manitoba and never had a fire at all. He had a bag, and he used to get into this bag and shut himself up in it, and lie down in the snow, and he came out of it perfectly well. But my belief is that surveyors have got to be like everybody else, they have to take care of their constitutions, because if they don't they will be miserable rheumatic individuals when they come to be old men. As to the division of timber limits to correspond with water sheds, we have had a good deal of trouble with the surveys in the Upper Ottawa district. Just as the timber gets more valuable, the lumbermen begin to question the validity of a survey, no matter when it was made or how long it has been there; they think if it is not exactly in the centre between two rivers it must be re-run, and they ask for instructions every now and then to re-run those lines, which, of course, were not run absolutely and accurately to an inch. It is a very difficult thing to run such a line—in fact, it is almost impossible for two surveyors to run the line the same. They go to work and traverse a river, and use their best judgment. Their lines may cross and re-cross each other, it does not amount to very much in the end, but it makes the two lumber firms bad friends. My belief is this, that when these lines are run there ought to be legislation to make them permanent.

The President—Those descriptions went to the water shed.

Mr. Kirkpatrick—Yes; they don't allude to the line that was run at the time they were first commenced. Then the lumbermen get an idea, and I believe the courts have held too, that the descriptions will hold, and not the work on the ground. I am told decisions have been given time and again in Ottawa in these timber surveys in which the license holds against the work on the ground.

Mr. Morris—No; I think the impression now, is that the work on the ground will hold before the license, and I think the lumbermen are beginning to understand that. They are getting over this looking for flaws in the lines.

Mr. Dickson—I think one great difficulty is the lines not being well blazed when they were first run. I know I have followed some of those lines, and it was very difficult, because they had not been properly blazed. I don't think it is possible for any surveyor to be too careful in blazing his lines. Every tree should be well blazed with three blazes on it.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

THE DUTIES OF A LAND SURVEYOR ON THE MAINTENANCE-OF-WAY STAFF OF A RAILROAD.

By W. L. INNES,

O. L. S. London.

It is a somewhat difficult matter to define exactly what the duties of a land surveyor on the Maintenance-of-way Staff of a Railroad—in his official capacity—really are. He will be called upon, of course, to do everything that cannot legally be done by anyone but an authorized land surveyor, such as laying out boundaries of properties. Besides this, he will probably also be required to perform a great many other duties which merge into the engineering.

In this paper the writer will attempt to describe in a very brief and imperfect way what are usually taken to be his duties. His principal duty as an authorized land surveyor on the maintenance-of-way staff of a railroad is to look after the real estate of the railway company.

His first step should be (if indeed it has not already been done) to very carefully compare the right-of-way plans with the deeds, and see that they show correctly the land actually owned by the company, then to go carefully over the ground and see if the fences are in the correct positions.

It will not unfrequently be found (unless those in charge of construction are more careful than usual) that in a large number of cases the fences are not in the correct positions, and generally speaking, that they are not " out " far enough.

Having discovered that a part of the right-of-way fence is not in the correct place, the surveyor should take steps to have it changed to its proper position, if it has not been the undisputed boundary of the right-of-way for more than ten years, in which case, of course, according to the " ten years statute of limitation of action " it forms the unalterable boundary.

Sometimes the railway company will actually hold the deed of a strip of land on one side of the centre line, fifty feet wide, while the fence only includes thirty-three feet. If, as is frequently the case, this fence has formed the undisputed boundary of the right-of-way for more than ten years, the seventeen foot strip not included by the right-of-way fence, is lost to the railway company, and may be credited to those who had the fencing in hand at the time of construction. If, on the other hand, the fence has been the undisputed boundary for less than ten years, the surveyor should have the fence put in the proper place, so as to include the fifty feet actually owned by the company, as before mentioned.

The question whether or not the loss of the land is greater than the cost of altering the position of the fence should be considered, as it may happen that the value of the land is less than the cost of altering the position of the fence. So that under these circumstances the fence should be left undisturbed and its position shown on the right-of-way plan.

It may seem peculiar that while there are a great number of cases similiar to the above, there are comparatively few in which the right-of-way fence includes more land than that actually owned by the company. When a railroad is first being put through, it is frequently more economical to cross a ravine with a trestle than with an embankment: this is also sometimes done for other reasons. At the end of the life of the trestle, of course it is necessary to either renew it or replace it with some other structure: usually, if circumstances will permit, a culvert of wood, or better, of stone, is made for the water, if there is any, or may be as a cattle-pass or undercrossing, and the trestle filled in. In all probability, if the trestle is at all high, it will become necessary to buy an extra piece of land on one or both sides of the track, in order that the new dump may not cover any land not owned by the railway. The surveyor will be required to make the necessary sketches and descriptions for the deeds of the extra pieces of land to be purchased; and after purchase to stake them out on the ground, so that the right-of-way fences may be put up in their proper positions. Speaking generally, the sketches and descriptions are simple, as the shapes of the pieces of land being transferred are generally rectangular, one side being the existing boundary of right-of-way, another parallel to it, and the other two perpendicular to it: however to eliminate errors, care is necessary.

In cities, towns or villages, the railway company may require a certain part of a building lot for right-of-way purposes, leaving the remainder of the lot of little value to the original owner; the owner will therefore generally under these circumstances require that the whole lot be taken. In the course of time, perhaps a manufacturer, a coal and wood man, or a grain merchant, may wish to locate somewhere convenient to the tracks of a railway company, and he may therefore wish to buy the portion of the lot not actually required for railway purposes. If it is decided to sell this land, the surveyor will be required to prepare the necessary sketches and descriptions for the transfer; or perhaps he may only wish to lease the land for a term of years, or the railway company may decide to only lease and not to sell the land. In this case also, sketches and descriptions are required for the lease similar to those for a deed.

Very often grain merchants and others seek permission to put up buildings on the railway company's property for the better carrying out of their own private business. The granting of such permission generally requires that they execute a lease for the land occupied by the site of the building, and of course a sketch and description is needed for this. As these buildings are usually placed parallel with the track, a description by metes and bounds is not required as is the case in most of the foregoing examples: a much simpler form of description may be adopted. The following blank form for such cases is very convenient.

Description of Site of......................, at.............., to be leased to.............. ....

In the.................of.............,County of.......... and Province of Ontario, being part of the.................Station grounds of the said Lessors, situate on.........Lot Number....... in the...............Concession of the said Township of......... and described as follows:—

A rectangular shaped parcel of land,...........feet........... inches in length, and...........feet...........inches in breadth, the.......................side being parallel to the centre line of ....of the Railway of the said Lessors. The.............boundary thereof is distant........feet ....inches,................at right angles from said centre line, and the................boundary thereof, produced, is distant......... .....feet................inches............... along said centre line from the................ ....

....

....

Said parcel being shown coloured pink on the attached sketch.

Sig..................

Engineer's Office,.....................

.....................189

As already stated, the principal duty of the surveyor is to look after the real estate of the railway company, and he may have to do this under the head of "extra land for numerous purposes," such as, for instance, ballast pits, road diversions, at bridges, at stations, for sidings, etc.

The right-of-way of branch lines a few miles in length is generally taken up by the company's surveyor, and have to be dealt with as new lines. For full particulars on this important subject, Right-of-way Surveys, you are respectfully referred to three valuable papers read before the Association of Provincial Land Surveyors of Ontario, at its fourth annual meeting held in Toronto, in the year 1889, and now embodied in its proceedings, by Messrs. H. J. Browne, Jno. Davis and H. D. Ellis.

As the sketches of extra land, land to be sold, land to be leased, sites of buildings etc., are continually accumulating, it becomes quite an important matter to have them properly filed, so that they may be easily and quickly found for future reference and for the purpose of making copies. A system that has proved to work very satisfactorily is to always prepare the sketches on tracing-linen in such a way that clear and distinct blue-prints may be made from them: file the tracings by pinning them to the leaf of a blank circular book of proper size, with the pages numbered, and index this book.

In order to obtain clear blue-prints, fairly heavy opaque lines must be used on the tracings, and for this reason black lines are to be preferred. It may be assumed that if the tracings with all black lines (except dimension lines, and they may be of carmine) are sufficiently clear, the blue prints also will be sufficiently clear.

The tracing should never be allowed outside of the office: send instead a blue-print which is just as good. Keep the tracing as the original, as a photographer does (or should do) a negative. Then, years afterwards it may be, when a copy of the sketch is required, it is only necessary to look up the index, unpin the tracing and make a blue-print to obtain an exact copy of the original sketch, and that too without any comparing, which is necessary when a tracing is made. By this system a great deal of time may be saved and mistakes avoided, as also a great deal of annoyance. It may also be added that this system of filing plan complies exactly with section 70, chapter 152, of the Revised Statutes of Ontario, a part of which reads: "Every land surveyor shall keep exact and regular journals and field notes of all his surveys, and file them in order of time in which the surveys have been performed."

A very convenient method of filing field-notes, is to number the field-note books and also the pages, and index up the notes under the head of the nearest station, using of course sufficient particulars to define what the notes are about.

A good method of filing all plans larger than those already referred to, whether they are rolled up or not, is to attach to the upper left hand corner of each plan, a small ticket with the number of the plan and number or other designating mark of the drawer or pigeon-hole to which it belongs, and by observing always to put the ticket on the same corresponding corners of the plans; in the index to place the number of the plan and number of the drawer or pigeon-hole opposite the corresponding entry, and to place the plans in the drawer in the same relative positions, so that the tickets with the numbers on are always together in the drawers, and in the pigeon-holes always on the outer end, no difficulty will be experienced in quickly finding them again, providing always, of course, that they are properly returned to their proper places.

DISCUSSION.

Mr. Morris—With reference to that description, the custom, specially in the city of Toronto, I understand, has been to give a description not by metes and bounds but with reference to the centre line of the railway without any tie to any concession or road allowance, that is a governing boundary. I have had a good deal to do with making these descriptions and duplicate plans for railways, and it was with the greatest trouble that I was allowed to expend the time in preparing proper descriptions; and I make it a point to make the description for a right-of-way property similar to a description of any other piece of land, so that it can be defined on the lot just the same as you could take a description from the registry office of any piece of property by metes and bounds. What made me think of that was, that not long ago a lawyer came to me and referred to that point, saying that it was impossible in some cases, in giving a title to a lot through which a railway ran, to define where this right-of-way was, that it might go through a valuable part or not. There was no way unless by going on the ground. So I have always made it a custom to give a more complete description, tying the ends of the centre line to some governing boundary.

Mr. Butler—Our deeds are all printed in that way. We attach a little plan to each deed, and the whole description is, the land shewn on the plan hereto attached coloured red, and those plans are filed in the Department of Railways and Canals. They are filed in the registry office for the county through which the railway runs, and on that plan is shewn the tying of the centre line to all the township and county boundaries.

Mr. Morris—Is the distance given in the description or on the plan?

Mr. Butler—Only on the plan.

Mr. Morris—Suppose the plan becomes detached from the description?

Mr. Butler—I hardly see how it could happen. We glue them all, and it has always worked satisfactorily so far.

Mr. Gibson—Would you make the location of the centre line to be governed by the corner of the lot?

Mr. Morris—Yes, the distance from the intersection of the lot boundary to the road allowance, whatever it might be.

Mr. Bowman—That is more or less quantities?

Mr. Morris—No, measure in most cases, and the survey made so as to make this accurate or nearly accurate. This distance is a check. I include the plans coloured red in the description also. The distances given might vary a foot or a few feet, owing to the concession lines varying in their course a little, which would be the difference.

Mr. Butler—There is one other duty a man has to see to, and that is that the taxes are paid.

Mr. Gibson—I have sometimes come across these descriptions. I remember one case in the county of York where the description referred specifically to the angles of the lots, and the centre line was governed by specific measurements, not plus or minus or anything of the kind, and you can just imagine what kind of a centre line that kind of a railway would have. I think both are necessary; it should refer to the corners of the lots by plus or minus. The possessory title and the actual line of survey should correspond. I think the centre line should govern positively, but I think reference should be made to the corners of the lots, otherwise you can't locate the property. I know I would always insist upon that.

The President—Suppose you have *both* marked on the map, which is going to govern?

Mr. Gibson—It is a wrong description, that is all. It should be marked plus or minus, because you cannot possibly shift that centre line.

Mr. Bowman—I have asked Mr. Butler whether he puts plus or minus to the distance of the centre line to the corner of the lot, and he says no. I think that is where the difficulty comes in, by not having a proper description by metes and bounds in his deeds. The plans might easily become detached from the deed, and they are not copied as the deeds, and that is why I think a description should be included with metes and bounds.

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LOCAL IMPROVEMENTS.

By P. S. GIBSON,

O. L. S., C. E., Willowdale.

THE object of the paper is to refer to certain parts of the law and procedure as to Local Improvements in which we are now particularly interested when called to act as engineers, and which may give rise to a discussion on the system which will be of much more importance to the Association than what I may say.

That the Local Improvement System has, on the whole, been a success may not be questioned, and that it has been abused is beyond question.

While any one may be able to shew serious defects in the system, yet it would be difficult to suggest a system which would accomplish the objects in view much better.

1. The leading principles of the system are, that persons in a particular locality may have improvements made at their own expense, and that the cost of such improvements may be extended over a term of years; and that by the corporation furnishing or raising funds for the same, the rate of interest may be low, and that the payments to be made shall be according to the foot frontage of the real property fronting or abutting upon the road upon which the improvements are made; or in some cases, where properties are *specially* benefitted, but not fronting on the improved road, a proportional part of the cost may be put upon them. While, generally, the rate is according to the foot frontage, in some cases it may be according to the area.

2. Again, in order to relieve parties who have improved localities by a large expenditure of money by themselves, a provision is made that under certain conditions the corporation may pay for the improvements already made and charge the same on the lands benefitted.

3. Again, in some cases the corporation may pay a part of the cost out of the general funds of the municipality, and in others may not.

Again, there may be a general by-law passed, with the assent of the electors, by which all expenditures of certain classes shall be specially assessed upon the property benefitted.

4. The above reference to a few of the features of the system show how general may be its application.

Another point for consideration is, that while for a time the advantages of the system were confined to cities, towns and villages, they were a few years ago applied to townships. So that the system is well worthy the careful study of every member of our association, whether he be located in a city, town, village or township. In making a study of the system the same difficulties arise as in the case of the Survey Act: the law has been so often amended and consolidated as to make it difficult to get a clear understanding of it, and yet it is of the utmost importance that the engineer shall have a clear and positive knowledge of the same, as it may be said that the success of the whole system depends on the knowledge and management of the engineer, as will appear.

5. Works may be commenced on petition or on initiative.

In either case it is of the utmost importance that the council should pass a procedure by-law, setting forth clearly the duties of each official.

6 In this general by-law it should be provided as to the form in which the petition should be drawn up. While the statute does not state as to form of petition, yet if the petition sets forth specifically the lands to be immediately benefitted where the assessment is to be made on the immediate frontage, it facilitates the work on the part of the corporation engineer and other officials, and more particularly so when the cost of the works is to be assessed upon lands fronting on other streets: and in either case it assists very much in the work of the court of revision, as any one signing the petition cannot afterwards claim that he or they were not aware as to how the costs were to be assessed. It also is of the utmost importance to the clerk or assessment commissioner, who may have to certify as to proportion in number or owners who have signed and as to the proportion in value of lands owned by them, and without such a provision it would be impossible for him to say until the engineer should make his report as to the lands benefitted.

The petition should be signed by all the parties who are to be assessed if possible, instead as required by statute by two-thirds, or three-quarters, or a majority; it should also set forth whether the petitioners desire the council to pay a part of the cost of the work, and if the cost is to be extended over other lands than those fronting immediately upon the improved road.

7. Another point should be carefully noted, that the petition should not ask for work to be done as pavements and sidewalks in the same petition asking for bridges, culverts, embankments and such other works as may be and are required to have the cost extended over roads not immediately benefitted; and also not include in such a petition an application to pay back to certain parties the cost or poron of the cost for work already done.

8. In the said general by-law the procedure should also be clearly stated as to the manner in which the council should act in initiating work, and the council should be careful to confine the initiation of the work to such as they have statutory right to do.

As a rule the initiation of local improvements should be avoided by corporations, as it is likely to give rise to the abuse of the system, and at same time cause litigation and a great deal of trouble to the council and officials.

The general by law should also provide that no petition should be referred to the officials for reports, or action taken by the council till a deposit of such a sum of money as may be considered necessary to cover the costs or expenses connected with reports of officials and advertising, and special meetings of council, where members of the council are paid. This will prevent many wild schemes being brought before the councils, and thus save much valuable time and also money.

It should also provide that such sums of money advanced should be recouped to the parties as soon as the works are proceeded with.

9. The flankage by-law may be included in the general by-law—the object of the flankage by-law being to make a suitable allowance for corner lots, by which say an allowance of 60 feet is usually made off the longer side of a corner lot, and in case of triangular or irregular shaped lots, a frontage of 1 foot is taken for each 100 feet of area. A question may arise in this connection as to what the frontage is of a goring lot, even if not a corner lot, where a street is on different bearings.

10. The general by-law should include the duties of the clerk and assessor or assessment commissioner, by which they determine if the petition be sufficiently signed, as whether two-thirds in number representing one-half the value of the property according to last revised assessment roll for ordinary local improvements have signed ; or where lands, besides those immediately benefitted, as lands fronting on adjoining roads are specially benefitted and require three-fourths in number and representing three-fourths in value to sign ; or in case of old works to be paid for, whether three-fourths in number representing two-thirds in value have signed ; or in case of corporation initiating work and the owners of lands to be assessed, petition against, whether the majority of the owners representing at least one-half in value have signed. It is plain that for a clerk or assessment commissioner to decide as to the signatures as above he must have at hand a complete and exact assessment roll, which in cities and towns and villages, where complete plans of same have been made, or in which plans of sub-divisions have been obtained, it may be all right, but in cases where the plans have not been arranged, or in cases of townships where the assessments are not made according to statute, or any other rule, it is a work of great difficulty unless as heretofore suggested the petition be got up to show the lands to be benefitted. To avoid difficulties of this kind the general by-law should require the petitioners to have a plan attached giving the required information.

11. The most important part of the general by-law refers to the engineer, a part of whose duties may be as follows :—

So soon as the clerk or assessment commissioner gives a certificate that a petition for work has been sufficiently signed the petition is referred to the engineer, who should make a first or preliminary report, recommending or not the work. In preparing this report he should carefully examine the petition, not only as to whether the work is advisable and necessary, but also as to the difficulties which may arise: as, for instance, damages to properties which, unless settled before the work commence, may amount to as much as all the work; in which case he should report recommending the work, provided parties who may claim damages agree to not claim the same, or are willing to accept a reasonable amount, which is to be charged to the local improvement.

Again, he may find that the petition asks for different kinds of work and that the cost of the whole shall be assessed over frontages besides those upon which the work is done, he should then report that as pavements or sidewalks, for instance, should only be assessed on the immediate frontage, while bridges may be built and also culverts and streets opened up and extended and cost levied on different roads; that the prayer of the petition is that the whole cost be spread over different roads, and where work not done, and in this case likely only the two-thirds in number, representing one-half in value have signed the petition, whereas three-fourths in number, representing three-fourths in value, is required, and then in townships only; that it would be advisable to have the petitioners put in two or more petitions, according to the class of works, and so the assessment may be suitably allocated, and debentures issued to be paid within life of the different works. Again, a petition may be put in for a sidewalk on one side of the road; if in a village or township a sidewalk on the other side may not be required for some time. Difficulties may arise in this case; both sides are benefitted, and if both sides to pay, the rate may be fixed for the side on which the sidewalk is to be laid, and the other side to pay one-half a rate, or in case only one side of the road is to be built on for a time and the other a side slope; in any of these cases it is well to have these difficulties pointed out in first report.

12. Again, a petition may ask for the opening of different roads, running in different directions, and asking to have certain lands assessed for such work; it would be well to ask that separate petitions be made for each road.

Again, a petition may ask for a road to be opened up over 66 feet in width in a township; it would be well to point out that the sanction of the county council will be necessary so the work may not be delayed.

13. Without further reference to difficulties to be attended to for making a first report, many of which will occur to you, let us assume that the first report required by the general by-law has been made by the engineer and approved by the council, he has next his second report which requires him to state in a simple case, (1) What real property will be immediately benefitted; (2) the probable lifetime: (3) the probable cost; (4) the proportion in which assessment is to be made; (5) to report total frontage or area, frontage or area exempt from taxation, and frontages or areas liable to assessment. A report of this kind to the engineer of a city or town where the plans of properties are available, and the assessment rolls are got up correctly, and

where an assessment commissioner is appointed, may not involve a great deal of work, but to a township engineer it is sometimes a formidable undertaking. In the first place, there is no complete plan of the part of the township, and likely few if any of the registered plans are in the corporation vault. Again, the township assessments are made in such a manner as to be practically of no use; so the engineer has to look up the plans and likely make a careful measurement of the whole frontages, from which he will prepare a plan shewing each individual front. The probable lifetime has to be fixed, as the running of the debentures depends upon that. The probable cost sometimes involves considerable work, where the improvements extend over a long road. As to the proportion in which the assessment is to be made, if the cost of the improvements is to be assessed over a wide tract of land, for improvements on one road, and nearly all the land is sub-divided into lots and streets, as in case of opening a new road, building bridges, culverts and embankments. If, on the road the improvements are to be made, one side for part of the way has a block of land not sub-divided, and the assessment is to be made according to foot frontage, the assessment may be made by fixing one rate for a particular frontage of lots, and then, in case of the block fronting on the improved road, put say two rates on that front, as it may have a very considerable depth, two or three times that of the ordinary town lots, and on the fronts of lots running into the improved road put two-thirds of a rate; and on lots fronting on roads running parallel to the improved road put one-third of a rate, and so on; sometimes one-twelfth of a rate, according to location and value of the land. It need hardly be said that in case of the assessment being spread over say 200 acres of land, which may have twenty registered plans, that a complete plan must be made, showing all the plans. From this complete plan all the other statements can be determined, and the plan can be referred to at courts of revision and used by the clerk.

The second report having been passed by the council, as per general by-law, the publication and holding the court of revision follow, after which the contracts are let and work carried on to completion.

DISCUSSION.

Mr. Butler—I would like to ask a question. Taking any town in a county, assuming that a majority of the residents on any street desire a sewer and petition the council asking for its construction under the local improvement plan, can the council be compelled to construct the sewer? I signed a petition myself without knowing all about the details to construct a sewer on the street upon which I live; all the ratepayers on the street signed the petition, and then the town council refused to put it in force or to order the construction of the sewer, declaring that they did not want to provide an outlet.

Mr. Gibson—Your scheme should include an outlet. The council are not bound to go and find an outlet. If you guarantee an outlet it is a different story. The courts will jump on them at once. The board of health is where you want to go to; get them to act.

The President—There was a remark made in relation to fractional parts in making assessments. I have always found it much easier for calculation to keep fractions out. I remember a few years ago we had a drain running through part of the town. There were a number of lots affected, and the party who went over it first was not a professional, and he made an estimate of the cost and he took about 300 lots and divided them into two or three divisions and assessed them in that way. We did not think that was fair, and I went over it and I made I think ten the highest and one the lowest, graded them in that way, 1 to 10. It kept fractions out, and you can easily calculate at once what they would be.

Mr. Gibson—The trouble I find in that case is this, a man commences at one rate and tapers it down to half a rate and so on down, then he thinks it is all right, but if you put one man 12 times as much as another they won't stand it.

Mr. Ellis—In regard to what Mr. Gibson was saying about damages to property. Very often in the case of paving or grading a street you are bound to go above or below somebody's property, and in most of these cases we have been in the habit of making a tracing shewing the profile of the street as it will be when it is completed, shewing exactly where the toe of each slope will run out to, and the cutting on each property and then going to the petitioners and saying: You must sign this plan and waive all damages, or if not, come to a settlement, or else have a clause in the petition in which it is stated that they will waive all claims for damages.

Mr. Abrey—That is all very well if all sign the petition, but in no case do all sign the petition. Then the difficulty comes in with those who have not signed. In my experience there has been that clause, where any person signing the petition waives all claims for damages usually. Lately we have also drawn a profile as Mr. Ellis suggests: but there are always some that don't sign the petition and they are the difficult ones to handle, and I think the only good practice is to go slow in that. This summer we have been sending agents around in all cases. For instance, a place like the Davenport Road where there are a great many persons interested and buildings have to be torn down, and three-quarters I suppose have signed the petition without any trouble; there are a few of them though that claim damages; some have their lots too long, others have their lots too short. We have been bargaining with these people all the summer and all the winter and we have reduced them down to four or five that have not come to some bargain. Formerly we rushed along too fast. Take Keele Street, it cost about $60,000 for work and $250,000 for damages. We have learnt better than that though, for this summer we have had no damages whatever; and I think by going slow and using a little more discretion, in nearly every case damages could be got rid of.

Mr. Ellis—In regard to the assessment of damages I find that sometimes if you will explain to the petitioners that every payment for damages is going to be assessed against everybody on the street and not paid out of the town or township rate it has a very cooling effect.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

A PLEA FOR A TOPOGRAPHICAL SURVEY.

By WILLIS CHIPMAN,

O.L.S., C.E., Toronto.

WITHOUT due consideration (in a "moment of weakness," as we Engineers put it) I yielded to the solicitation of our esteemed Secretary and offered to present a paper at this meeting on "Summer Resorts." For reasons which will soon be apparent, the paper to be presented, if under its advertised title, would resemble Josh Billings' lecture on "Milk," which no doubt some members of this Association have listened to. Not wishing to appear as an imitator of this great American "moralist," I will take the liberty of changing the title of my paper to that of "A Plea for a Topographical Survey."

In commencing my investigations *re* our summer resorts, I very naturally began to study the "Map of the Province of Ontario, shewing counties, townships, railways and post offices, 1889," issued by the Department of Crown Lands. In examining this map previously I had discovered several errors, chiefly clerical errors, if they may be so called. In lithographing the draughtsmen who prepare the drawings on the stones may misinterpret the copy sent in, and during the printing some defects may make themselves manifest, from abrasions on stones, faulty manipulations, etc.

I was wholly unprepared, however, for the unpardonable and unexplainable blunders exhibited in this map of our Province that is now being presented to the civilized world, and is to be found hung in the offices of surveyors, lumbermen, capitalists, tourists, and persons who are sufficiently patriotic to be proud of their country.

I will now call your attention to some of the inaccuracies, beginning with that which first arrested my attention when investigating our summer resorts.

The Lake of the Thousand Isles is famed the world o'er for its beauty, and attracts thousands of tourists every year, yet there is no trace of it on our Crown Lands map.

Passing down the St. Lawrence, where are the great rapids, and those river expanses Lake St Francis and Lake St. Louis?

Travelling up the Ottawa, where are the beautiful Lake of Two Mountains, the Chien Lake, Lac du Chat, Lac Allumette, Lac Calumet, and the Coulonge?

In my native county, if the township of South Crosby were cut out from the map and the names erased, I am convinced that there is not a resident of the township that would recognize it. The central part of Frontenac is a *terra incognita*.

About twenty-five years before the present map was perpetrated, the greater number of the older counties in the eastern part of the Province were mapped by private enterprise and sold by subscription. Glengarry, Stormont, Dundas, Grenville, Leeds, Frontenac, Addington, Lennox, Lanark, Carleton, Russell and Prescott, in the east, were so mapped, and much credit is due to the publishers for the way in which they performed their work. The basis of all these maps were the plans in the Crown Lands Department, but the straight concession lines and boundary lines of the Crown Lands Department plans were shown as they were actually run. By a house-to-house canvass for subscriptions, information as to depths and widths of township lots, lands in surveyed lines, location of streams, sketches of lakes, etc., etc., was obtained.

Why did not the Crown Lands Department avail itself of these old and comparatively reliable plans in compiling its new plan of the Province? If this had been done there would now be little to make complaint about in the eastern part of Ontario.

In our Canadian North-West Territories, and in a large part of the area between the Rocky Mountains and the Mississippi River in the United States, the aridity of the climate produces many lakes and ponds without outlet, which thus become alkaline. A person settling in this alkaline country, unacquainted with Ontario, would from a glance at our Crown Lands map infer that a great portion of Northern Ontario was an alkaline desert, dotted with innumerable lakes and ponds without outlets, a region unfit for the abode of man.

In Frontenac examine the townships of Miller and Barrie; in Lanark the township of Levant; in Hastings the townships of McClure, Faraday, Limerick, Herschell and Cashel; in Peterborough the townships of Galway, Chandos and Methuen: in Victoria the townships of Carden and Longford: and in Renfrew the townships of Radcliffe, Jones, Wilberforce, McKay, Buchanan.

Are the physical features of these townships as shewn on the original plans of the surveyors who made the survey? If so, re-surveys are needed.

I believe that better plans of these townships could have been compiled by the bush-rangers of the various districts, without reference to the surveyors' plans in the Department.

In the Haliburton District we find in the following townships evidences of errors that would be apparent to an aborigine or a school-boy: Havelock, Eyre, Lawrence, Hindon, Guilford, Harburn, Bruton, Harcourt, Cardiff, Dudley and Anson. One of our ex-presidents has work enough here in his native district to keep him fully employed for the remainder of his natural life.

In the Muskoka and Parry Sound District we come to surveys of recent date, where the surveying instructions are more concise, the compass not used exclusively, yet we find in the following townships errors of the same nature as those referred to in the preceding counties and districts: Hardy, Mills, Gurd, Brown, Wilson, Strong, Lount, Ferrie, Burton. Hagerman, McKellar, Spence, Chapman, Proudfoot, Christie, McMurrich, Perry, Bethune, Humphrey and Foley. Mowat is all right apparently, also Laurier.

In the Muskoka District glance at the townships of Wood, Morrison, Oakley and Stisted. Are they correctly mapped ?

In the south part of the Nipissing District please examine Lyell, Preston, Freswick, Cameron, Osler, Guthrie, Biggar, Butt, Hunter, Sproule, Canisbay, Master, Bishop, Murchison, McLaughlin, last but not least, the two townships named after two renowned (for different reasons) surveyors, Niven and Fitzgerald.

I doubt if there is a township in this southern part of the District that is correctly mapped.

In Figure 1 the township of Biggar, as shown on this Departmental map, is given, and in Figure 2 the principal lakes and water-courses, as given in the returns. This township was surveyed in 1882.

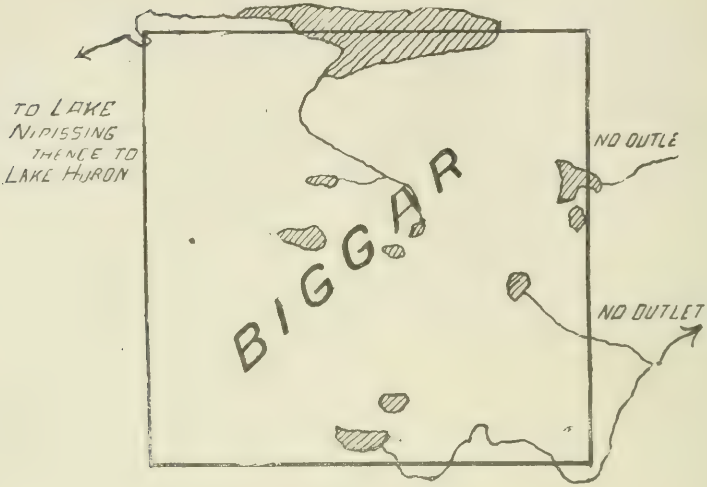
TO LAKE
NIPISSING
THENCE TO
LAKE HURON
NO OUTLE
BIGGAR
NO OUTLET

FIG. 1.

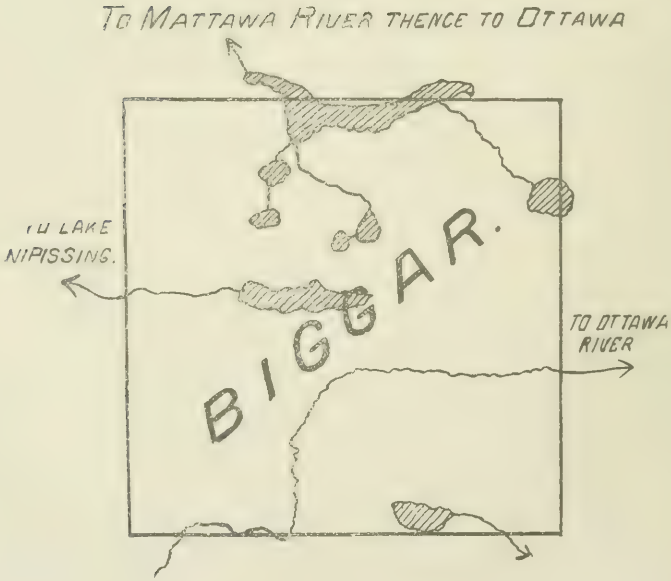
TO MATTAWA RIVER THENCE TO OTTAWA
TO LAKE
NIPISSING.
BIGGAR.
TO OTTAWA
RIVER

FIG. 2.

In the north part of the District, where I have surveyed four townships, the same gross mistakes appear. For example, here are the two townships of French and Muloch, surveyed in 1884 and 1886, several years before the map of the Province was issued. Figure 3 gives the physical features as shown in the Crown Lands map. Figure 4 gives the physical features as they actually are and as returned to the Department.

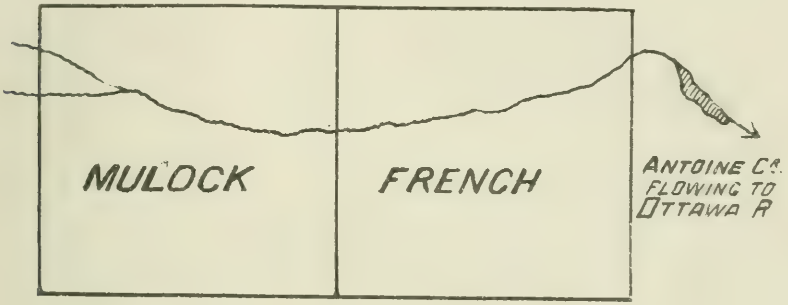

FIG. 3.

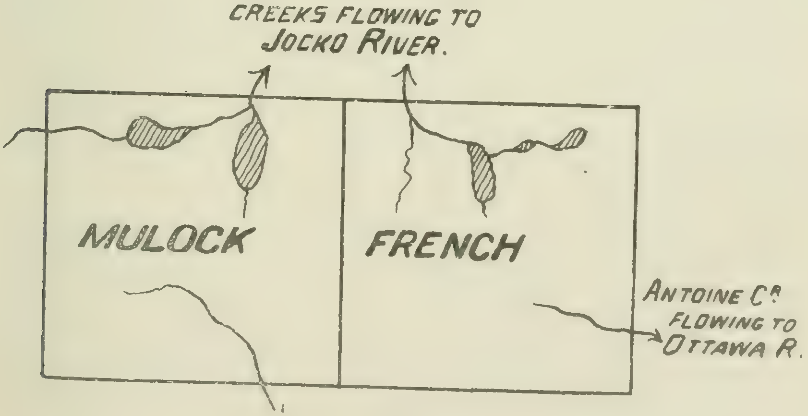

FIG. 4.

Hawley, Broder, Grant, Phelps, Widdifield, Olrig, Kirkpatrick, and many others are blanks. (Kirkpatrick has a railroad.)

In Eastern Algoma the many surveyed townships that are "waterless" is astonishing, while Mack, Plummer, Meredith, Galbraith, Waters, Ermatinger, the land of Goschen, and dozens of others are alkaline deserts.

Through all the northern districts of Ontario are lakes from five to twelve miles in length, nameless.

Even in older Ontario we fail to find the following rivers: -the Petawawa, the Clyde, and the Carp.

In the west and central:—the Eremosa, the Conestoga, the Nottawasaga, and the Saugeen are not named.

Endeavour to trace on the map the watershed between the rivers flowing into the Ottawa and those flowing into Lake Huron, or the watershed of the Madawaska from that of the Bonnechere or the Petawawa.

Is it of no value to our mill-owners and our capitalists to know this? Is not a thousand square miles of watershed of great importance in determining the value of a water power?

I think I have adduced sufficient evidence to convince any member of this Association that the best map we have of our Province, and issued by the Department, is grossly incorrect, and is misleading to the settler, the prospector, and the investor.

I would not dwell at such length upon this matter, nor would I specify particular townships that are in error, if I did not feel that some portion of the disgrace attending this matter falls upon this Association, many members of which have furnished the Government with correct plans of the surveys made by them, and the public should know that the surveyors of this Province are not responsible for the grosser errors the map contains.

Since 1887 the Dominion Association has been urging upon the Federal Government the importance and necessity of a triangulation survey of Canada, but so far their efforts have not been crowned with success. During these five years our Association has done nothing, leaving this matter entirely in the hands of our Ottawa brethren.

I now propose that this Association devote a portion of its energy in educating our legislators and the public in this important matter, without infringing on the rights and duties of the Dominion Association.

The determining of the latitude and longitude of several principal points in the Province, and the primary triangulations, I would place in the hands of the Dominion Topographical Surveyors who are members of the Provincial Association. The hydrographic work might also be placed in the hands of the Dominion Government.

The secondary triangulations and all topographical work should be done by the Provincial Government, the degree of minuteness depending in general upon the density of population.

We must have a topographical survey made of our Province—the sooner the better—and I believe that this incorporated Association is the proper body to take the initiatory steps. Our Legislature will not proceed with the work until it is demonstrated fully that it will pay to have this work done, and it lies with us to compile facts and figures to show the cost, the method in which work is to be done, and its utility when completed.

I am of opinion that our Standing Committee on Engineering should be abolished and that we appoint in its place a Standing Committee on a Topographical Survey.

DISCUSSION.

Mr. Dickson—I have been struck myself with the number of lakes in that plan that are not as accurate as they might have been. The route of streams is not shown. I have always maintained, and I think I mentioned it once before this Association, that all the water should be shewn connectively as it runs through the townships. A great many of our surveyors don't do that; they simply shew a body of water without any outlet. It is not at all difficult for them even to trace creeks with dotted lines.

The President—I think that perhaps Mr. Chipman is not finding so much fault with the plans in the Crown Lands' Office, as with the compiled plan here. Is that not so, Mr. Chipman?

Mr. Chipman—Yes.

The President—Well, when we look at the size of this plan it would be impossible to put all the topography in correctly.

Mr. Kirkpatrick—With a great deal of what Mr Chipman says I cordially agree, but as I had a good deal to do with the construction of that map I may say that the fault lies with the surveyors themselves. The inception of that map took several months, and I was so particular that every county should be accurate that we sent pieces of each county to every surveyor in that county asking him to put on everything topographically that he knew of, every post office and everything; we sent to each post office inspector of the province copies of the map, asking that all the post offices and all information of any value should be given; and we sent to every railway company copies of the map, asking that all the railways should be put on. In the Ottawa and Huron districts there are thousands of lakes which could not be shown on that map. All the maps on which alone we could act in the eastern territory were the original maps in the Department of Crown Lands, and on these there are no outlets shewn. Lakes are unnamed, and the lakes that are on the map I am perfectly well aware, just as well as Mr. Chipman, that they form no resemblance to the lakes on the ground. That is no fault of the Department; it simply shews the necessity of a topographical survey. Unfortunately, we have only been able to act on the information that we have. With regard now to copying county maps, that might be very well as a private speculation, but it would be utterly impossible for the Department to take county maps over which they have no control and lay down information from these county maps, because we are not aware how much labour has been expended and we have not the local knowledge of how much these county maps show accurate surveys, or are drawn on the imagination of the canvasser who went through the county In the Huron and Ottawa Territory a great deal of what Mr. Chipman has mentioned is perfectly true, that the lakes are unnamed; but we have not got a microscopic press, and if we named every lake in the Parry Sound district there would be nothing but a succession of names. It is utterly impossible. I am aware that those lakes spoken of are the head waters of the Madawaska, but I cannot undertake to make the maps shew what the maps in the Crown Lands Department do not shew. Mr. Dickson has brought it to our attention before this, and we have put it expressly in the instructions, "You will please shew courses of the streams with the inlets and outlets of all lakes." But the point I want to make is this, that to every surveyor that we knew of—and most of them that are here will bear me out in remembering it—copies of these were sent, because I sent them myself, with the request that they would put on all the information they could so as to make the map perfect. Of course it will bear criticism, but I have also been told over and over again that it is the best map that has ever been published in Ontario, with all its faults. But we hope to make it better with every edition.

Mr. Chipman—While it is perfectly true that in the older parts of the province this is probably the best map that has ever been published, I can see no reason why in the northern portions the map does not shew the water sheds of the chief rivers as the surveyors reported them to the Crown Lands Department, as shewn on the original surveys of these townships. In three townships that I surveyed the physical features were correctly noted, and so returned to the Government, but they are shewn quite differently on that plan; and these surveys were made several years before the map was published—one seven, and the others four or five years. I can see no reason for that. I don't complain about the small lakes not being shewn, you cannot expect that, but there are lakes shewn 8, 10 and 12 miles long that have no name at all. I think it would be much better if we named the larger ones and omitted the small ones altogether. Then there is no reason for not shewing which river is the Madawaska and which is the Bonnechere. It is known by every bush-ranger up there which is which, and which lake is which. I went over the County of Renfrew with Mr. Morris yesterday or the day before, and we found it was full of inaccuracies. There are large lakes in there that have been known for years, all about them, which way the outlet is and everything, but they are not so shewn on the plan.

Mr. Niven—As far as names of lakes are concerned, I think sometime ago a paper was read before the Dominion Land Surveyors' Association suggesting that the lakes of our country should be named after some system; it was very confusing putting down the names of lakes as they were named by surveyors. You will find a dozen Loon lakes and a dozen Bear lakes, and Crow lakes innumerable, and all sorts of names I have in many instances refrained from putting a name of a lake on my plan at all. I think, unless the proper name is known, it is better to let the name go. The Indian name should be retained when practicable.

Mr. Chipman—In tracing water sheds for ascertaining and determining the volume of water in our great rivers I found it impossible to determine which was one river and which was another.

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SHALL IT BE A TILE DRAIN?

By HERBERT J. BOWMAN,

A. M. Can. Soc. C. E., Berlin.

THIS question arises in connection with the drainage of a number of farms at the headwaters of Cedar Creek, in the Township of North Dumfries, in the County of Waterloo.

In a cedar swamp, just south of the road allowance between concessions 11 and 12, is the actual and never failing source of the creek, but the lands to be drained are situated above this, where there is in reality no creek at all, but simply a run of water in the spring and after very heavy rains. This flood-water is carried off in a shallow ditch joining a series of marshes, as shewn on the accompanying sketch; but as the fall is very slight, less than 1 in 1,000, the low ground along this watercourse dries out very slowly, and chiefly by evaporation, which by its chilling effect renders the ground too cold to grow any crops successfully. This low ground extends all along the watercourse, widening out at the marshes, and is estimated at about 200 acres requiring underdraining. All the land is cleared along the watercourse.

There is no doubt but that a large open drain could be dug to carry off the flood-water in the spring, and at the same time afford the necessary outlet for the lateral tile drains required through the low ground. Objection is, however, made to this plan on account of the trouble and expense in keeping the ditch open, especially through the several marshes, where the ground is soft and peaty, and where cattle will be pastured. Another objection advanced against the open ditch is, that it adds greatly to the labor of working a farm, more particularly where it runs diagonally across the fields; also, if the ditch is deep and has proper side slopes the land taken up by it is considerable.

Hence a number of the owners of these farms are desirous of having a covered drain, if one of sufficient capacity can be constructed at a reasonable cost. In fact they have been figuring on a drain to be made of 10-inch ordinary agricultural tile, and have put the cost at about $2,000 for the 18,000 feet required.

Before going into the question of the required capacity of the tile drain, it will be necessary to know the amount of the rainfall in this district, which may be obtained from the following table kindly furnished by the Director of the Meteorological Service :—

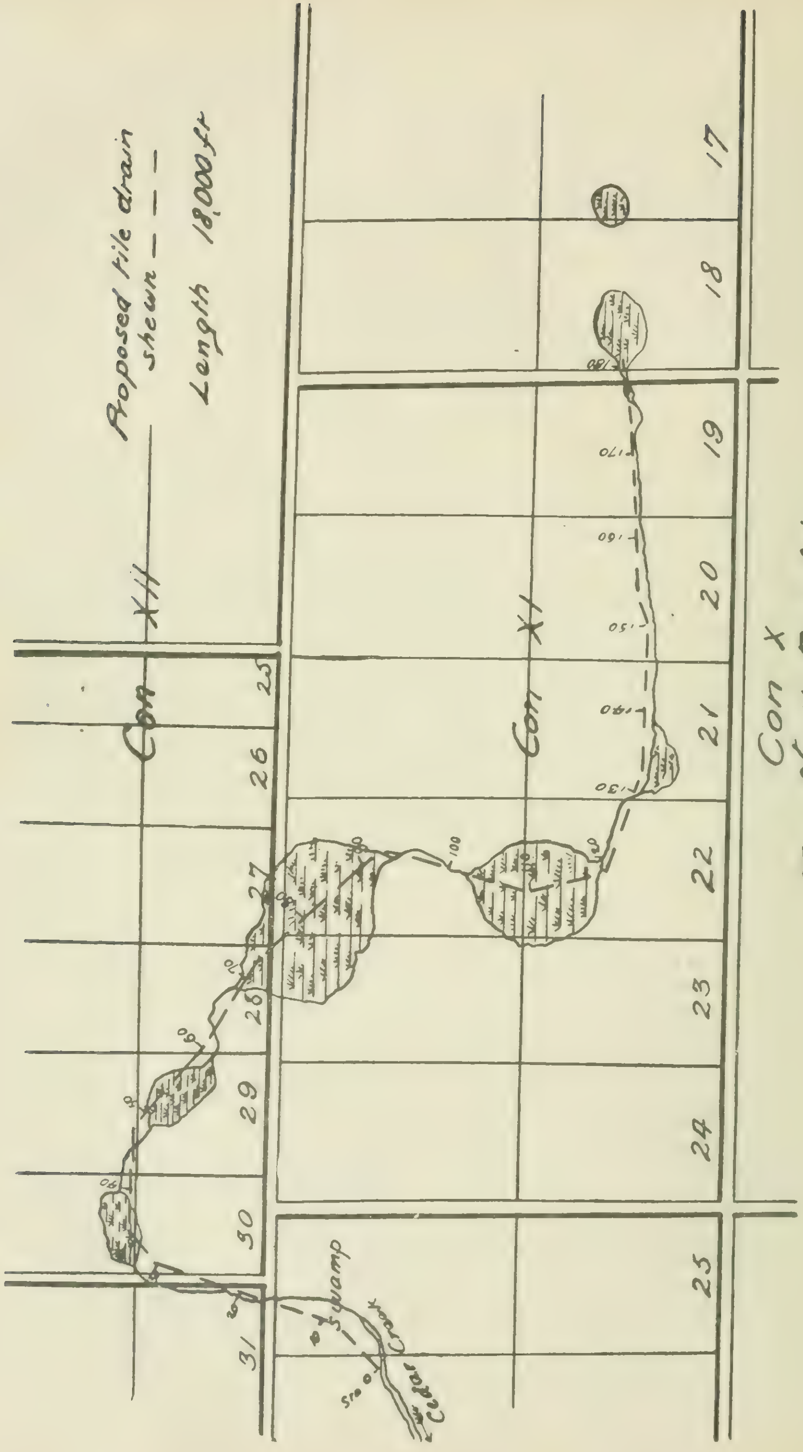
Proposed tile drain shewn – – –
Length 18,000 ft
Con XII
Con XI
Con X
Tp. North Dumfries
25
26
27
28
29
30
31
17
18
19
20
21
22
23
24
25
Swamp
Cedar Creek
Sta 0
10
20
80
90
100
130
140
150
160
170
180

TABLE GIVING AVERAGE TOTAL PRECIPITATION (rain & melted snow).

STATION.	YEAR.	JAN.	FEB.	MAR.	APR	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
Guelph	1881-92	2.32	1.78	1.67	1.45	2.07	2.73	2.12	2.51	2.07	2.11	2.37	2.42
Galt	1878-90	2.25	2.66	2.20	2.29	2.34	3.13	2.88	2.48	3.12	2.52	3.42	3.00
Fergus	1883-90	4.09	3.65	3.00	2.70	3.20	3.83	2.58	2.34	2.48	2.93	3.58	3.96
Conestogo....	1880-90	3.35	3.10	2.61	2.11	2.95	3.94	1.96	3.14	2.26	2.94	3.39	3.22
Stratford.....	1860-87	3.36	2.94	3.21	2.45	2.89	3.35	3.19	3.36	3.16	3.56	3.63	3.87

10 inches of snow is taken as equivalent to 1 in. of water.

Meteorological Office.
Toronto, 2nd Feb., 1893.

CHARLES CARPMAEL,
Director.

In this part of Ontario, during the months of December, January, February and March, the ground is frozen and does not absorb the precipitation, which is mostly in the form of snow. Part of this is evaporated, as it is a well-known fact that a block of ice will diminish in size even in the coldest weather, but by far the greater part is carried off over the surface of the frozen ground by the spring freshet. Hence the rainfall of only the remaining eight months of the year will be carried off by a tile drain, and perhaps not even all of that, for in the heaviest storms some of the water will flow over the surface and be carried off by the present shallow drain. From the table it will be seen that at Galt, less than five miles from the drain, it was found by systematic gauging for 13 years, that the rainfall averages 22.18 inches in depth for the eight months, April to November, both inclusive. This depth will be found to be almost exactly equal to the average of all the other stations given in the table, these stations being all within a distance of thirty miles of the drain.

Now 1.00 in. of rain on 1 acre of land yields 22,622 gals. Imp. of water.
" 22.18 " " " " " " 501.755 " " "
" 22.18 " " 200 acres " 100,351,000 " " "

which may be taken as the amount of water to be discharged by the main drain in a year.

There is no doubt, however, that in very heavy rains, some additional water will reach the area requiring drainage from the surface flow off the adjoining high lands, but the greater part of this will be carried off, as before mentioned, by the present shallow drain. Provision should be made to retain the rainwater on the high land, so that it may be absorbed, or it will carry off the finer or more soluble parts of the land over which it passes. This may be done by running the furrows, in plowing, horizontally along the hills; and in grass lands, by having frequent, small, horizontal ditches, for the same purpose, for, "in descending through the soil, this water, in summer, gives up heat which it received from the air and from the heated surface of the ground, and thus raises the temperature of the lower soil. The fertilizing matters which it has received from the air—carbonic acid, ammonia, and nitric acid—are extracted from it, and held for the use of growing plants."

Again, some additional water will reach the area requiring drainage, from below the surface; that is, from springs, being in reality rainwater which has already given up all its fertilizing matters to other soils more or less distant. Its effect is chilling and hurtful, and it should be kept down from the surface and removed as rapidly as possible.

On the other hand, the quantity of water to be removed by the tile drain is lessened by the amount taken up by the growth of the crops raised on the land, but of this there does not seem to be any available data. Evaporation also lessens the amount to be removed. It has been found from experiments made in England that the average evaporation of water from wet soils is equal to a depth of two inches per month, from May to August; and in this country it must be even greater—in the summer months, in all probability, being nearly equal to the rain-fall, besides removing the dew which is no inconsiderable item. However, in well-drained land the amount of water evaporated is reduced to a minimum, and will not be sufficient to so lower the temperature of the soil as to retard the growth of the crops; but at the same time a large portion of the rainfall must be removed in this way.

From the foregoing it will be seen, that although there are additions to the actual rainfall on any area of ground, which vary according to the surroundings, at the same time there are forces always present tending to lessen the amount of water to be removed by the tile drains. It must also be borne in mind that the main drain will not remove the total rainfall in the summer months unless the whole area is thoroughly drained by a system of lateral drains. Where the depth of these drains is four feet, the distance apart may be forty feet, and on this basis each acre would require 1,100 lineal feet of lateral drains, and 200 acres, the area in question, would require 220,000 feet, or upwards of forty miles of drains. It is very doubful, however, if even half of this work will be done within the next score of years, so that ample capacity will be obtained if the main drain is designed to carry off in the 365 days of the year, the water resulting from the rains in the months of April to November, both inclusive.

Therefore, the question becomes one in hydraulics, and is: Will a 10 inch common tile, which is about the largest size made, carry off 100,351,000 gallons of water in a year, the available fall being only 1 in 1,000.

From Chezy's general formula we know that where

A = area of cross section of conduit in feet,
C = co-efficient determined by experiment,
R = hydraulic mean depth in feet,
S = fall in any distance divided by that distance, being the sine of the slope.

Then the discharge in cub. ft. per sec. $= AC\sqrt{RS}$

$$= AC\sqrt{R} \times \sqrt{\frac{1}{1{,}000}}$$

$$= 20.095 \times \sqrt{\frac{1}{1{,}000}}$$

This value of $AC\sqrt{R}$ is taken from a very handy little book of tables by P. J. Flynn, C. E. (VanNostrand's Science Series), calculated by Kutter's formula for finding value of C. The highest value given in these tables, however, for the co-efficient of roughness is $n = .013$, which is probably rather low for a tile drain. Therefore, to be on the safe side, about 10% has been deducted from the calculated discharge, leaving it at 300,000 gallons (Imp.) per day, at which rate the 10-inch tile drain will discharge the rainfall from the 200 acres, namely: 100,351,000 gallons of water, in considerably less than a year, or to be more exact in 335 days.

DISCUSSION.

Mr. Tyrreil—Would not the greater part of the water be required to be carried off in the spring when the snow melted, during a very small fraction of the year?

Mr. Butier—It always seems to me that the problem is not what is the annual rainfall? but, what is the maximum rainfall within a given short period of time? Perhaps within a couple of hours some inches of rain might fall, and that is the rain that does the damage. Without going into the calculation for the size of the pipe, which seems to-be ample for the purpose according to the calculation there shewn, still the question would rise naturally, if two inches of rain fell on that area, say during the night, would that ground be saturated to such an extent as to scald and destroy the crop? That is the way I would approach the solution of a problem of that kind. If it could not be relieved within the next four or five or six hours, at the outside, I would consider that the drain was inadequate.

Mr. Miles—According to that demonstration the rainfall that took place in 240 days will take 335 days to carry it off?

Mr. Bowman—Yes. In regard to the question Mr. Tyrell brought up, I assumed that during the months of December, January, February and March the ground would be frozen, and I think you will find that in frozen ground very little of the water would be absorbed; it would go off over the surface instead of sinking in. Of course some of these marshes might absorb more, but that is just a suggestion of mine, and I would be glad to have your opinion on it. I don't think it comes to a question of the rainfall of one day being discharged in that day. We will suppose we have the soil well drained to start with, the water being well drained off, as in summer. (Draws diagram on the blackboard.) Here is a tile drain every forty feet. Supposing an inch of water-fall in 24 hours, which is about as large a quantity as we need figure on—there are heavier storms sometimes than that, but still there are some years without even an inch in 24 hours. It has been found that that inch of water will sink down through the ground four feet, in perfectly well drained soil, and that one inch can be taken up between the particles of the earth in about four inches of depth, so that it would not effect vegetation at all; it would be down three and a-half feet anyway below the surface. I don't expect the rainfall of one day will be carried off in that day. Tiles run all the time, so I was giving the whole year, 365 days, to run off the rainfall, and you will find it will do it in 335 days.

The President—You did not make any allowance for evaporation.

Mr. Bowman—I allowed evaporation and water taken up by the plants to counter-balance the water from springs and any surface water that might come in from the higher ground at the side.

Mr. Abrey—The assumption would be that the drain would be running full all the time?

Mr. Bowman—It would be making its maximum discharge.

Mr. Abrey—In dry weather it would not be doing that, therefore in the balance of the season it would not carry it off.

There is no reason why it would not be running full all the time if there is water there to carry off. In fact it might be running under a slight head sometimes, in which case it would discharge more.

Mr. Winter—I think you will find that that drain is not large enough. I think the principle of the paper is wrong. It would have to be calculated so that when there would be a heavy flood for a short time it would carry off that water. When there would be a heavy fall of rain one day you could not give it more than another day to run off. I think the principle of taking up the full year would not give you a large enough drain.

Mr. Tyrell—As far as my experience goes, I may say that it appears to me that the great bulk of the water flows away in the spring and fall of the year. In low, swampy ground the frost does not go into the ground to any extent. I know in a swamp out in Wentworth of about 2,000 acres, which I drained two or three years ago, during the summer months very little water passes down the drain, whilst in the spring of the year it always has been full up to the top. However, it is just an open drain about six miles long.

Mr. Morris—I think from the information we have got you would expect in certain wet seasons of the year quite a large lake to form at the upper end of that drain with probably a washout, because you can hardly calculate the drain to even up the time during the whole year to discharge the water, especially in large quantities. In a level country like that it would hardly be carried off by a drain of ten inches.

Mr. Bowman—I think you have not quite got the situation. There is a shallow ditch there now, and this land gets along very well in the flood time now. They plowed this low land, but the water comes up and so chills the ground that they cannot raise any crops on it. This man that owns it says it is not worth $10 an acre to him now, but if he can have it thoroughly drained it will be $70 an acre.

Mr. McCulloch—You propose to put it so that it will absorb the rain and prevent the water accumulating on the surface?

Mr. Bowman—Yes.

Mr. McCulloch—I was hoping Mr. Bowman would give some solution of the question whether it should be an open or tile drain. I happen to know a little of that locality myself. He seemed to object to the tile drain for the reason that he could not get water in during the time the ground was frozen. I think by putting in catch basins along that drain the water can be taken off very quickly in the spring without having that objection, by building branches on the surface of the ground to these inlets.

Mr. Ellis—How do you propose to lay those tiles?

Mr. Bowman—I propose to lay them very carefully by putting up sights for them every 500 feet and then with a boning rod, and then probably have an inch plank, six inches wide, under them the whole distance. They have to be laid very carefully. A few inches of fall lost would seriously retard the flow. There is only one foot fall in 1,000. I have found that tile drains work very well at one in 1,000, Central Park, New York, has its main drain laid one in 1,000, and I think they are 10-inch too.

Mr. Ellis—In Central Park they lay them with tar paper at the joints.

Mr. Tyrell—I think with Mr. Bowman's explanation that the surface drain could still be maintained to carry off the flood water, that it would no doubt be a good thing for agricultural purposes.

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THE MEXICAN AMALGAMATION PROCESS.

By SAMUEL BRAY,

C. E., O. L. S., Ottawa.

It is to be hoped that in the near future surveyors will be called upon to make surveys of mines and mineral properties more often than in the past. Surveyors are fairly versed, at least at the time we pass our examinations, in the general characteristics of minerals, and I have no doubt that some of our members will drift from the survey of mines into the actual working of them, either as owners or as managers.

For years, for centuries rather, the mines of Mexico supplied more than one-half of the silver used throughout the world. Practically the whole of this silver was extracted from its ores by the process known as the "Mexican Amalgamation Process." This process was eminently adapted to a warm country where wood and water were scarce and where it was consequently necessary to resort to animal power. It is not adapted to Canada, and will probably never be adopted, but as silver has been found in large quantities and will probably be found in the future in much larger quantities in different parts of the Dominion, I have thought that a description of this process may be of some interest to our members.

Those ores of silver, commonly known as "chlorides," can be successfully treated by this process, and sulphurets, after having been submitted to a continuous heat in a reverbratory furnace, also yield good results.

The ores are crushed under the ordinary dry stamps and passed through ¾ inch sieves ; they are then ground to an impalpable powder, or rather fine mud, in very primitive, but very effective mills, called "arastres." These mills are circular, usually 12 feet in diameter and paved with rough granite blocks two feet long and eight inches thick, set on end. An upright axle in the centre of the mill carries four arms ; to each arm is attached, with plugs and ropes, a large rough granite block, about four feet long and two feet through. These blocks are dragged around and around on the paved floor of the mill by a pair of mules hitched to one of the arms, which projects for this purpose beyond the rim of the mill. The rim of the mill is made of three-inch stuff set upright and close together like the staves of a cistern. The mules are blind-folded, otherwise they will require constant driving to keep them moving. Two pairs of men, who relieve each other every 12 hours, are usually in charge and do all the work required in connection with twelve of these mills. The mules are also in two sets, but they relieve each other every six hours. A large silver reduction works or "Hacienda de Beneficio," as it is called, will have about 70 heads of stamps, and 70 of the above described mills, which will crush and grind about 30 tons of ore per 24 hours.

About half a ton of crushed ore is placed in each mill, water is added from time to time, and finally, when the grinding is complete the mass has become very thin mud. This is now run off into tanks of masonry and allowed to settle, the water drawn off, and the residue spread out in the amalgamation yard into large circular or oblong masses about 10 inches thick, called "tortas."

Common salt is now scattered evenly over the torta; the quantity required is in proportion to the richness of the ores, which is previously ascertained by assay—6¼ per cent. may perhaps be an average. Also the quantity of salt required is regulated by its pureness. If the common "sal tierras" are used a larger quantity will be required, and as these "sal tierras" vary exceedingly in the percentage of pure salt contained in them, it is well to assay them before deciding on the quantity required.

The salt and all the other ingredients used are mixed into the mass or torta by horses or mules treading through it. A torta of 120 tons will require about 20 or 25 animals; these are driven by one man in continuous circles around himself, he takes care to keep moving over the torta in order to insure that the whole of it is evenly and thoroughly mixed. This man is provided with a long whip and simply holds a rope as a halter-strap, about 15 feet long, leading from the head of a leading horse of five-abreast, which are simply tied together by a rope from neck to neck, sufficiently short to keep the horses together and yet allow them room to move freely; from the neck of this leader a rope passes back to the second leader of a similar set of horses, five-abreast; and similarly a rope passes from this leader to another behind him and his set of five horses, and so on. I have seen fifty horses driven in this manner by one man on especial occasions and for a short time, but it is not advisable to allow more than 25 to be driven by one man.

In a large hacienda, such as I have mentioned, about twelve tortas will generally be under treatment at one time. These are mixed in the above described manner on an average of every other day for about one month, so that six or seven of these tortas are being trod by horses and mules every day—say 130 animals plod through this mud day after day driven by only six or seven men. It is surprising how rarely an accident occurs, especially when it is to be borne in mind that the animals detailed for this service are those that are either unbroken or nearly worthless for any other work. Sometimes a couple of animals will quarrel and mix up the whole lot in almost inextricable confusion, or perhaps one may fall and entangle the others; in these cases the driver and the other men at work at the torta have to be as quick as possible in untieing and cutting the tangled ropes, as in less than one minute a horse might be lost by having his head pinned down into the mud by his companions.

The day after the salt is applied, sulphate of copper is added to the torta, either in a pure state, as obtained from the Mint, where it is a necessary residue in the operation of extracting the gold contained in nearly all bars of silver received at the Mint, or it is applied to the torta in a finely pulverised and calcined ore of copper, called "magistral." In case magistral is used it is advisable to assay it in order to ascertain the percentage of sulphate of copper it may contain. As pure sulphate of copper cannot always be obtained, all large silver reduction works using the Mexican Amalgamation Process are provided with reverbratory furnaces for the purpose of preparing their own magistral. The copper ore is stamped, ground in the arastres and allowed to dry. In the dry state it is necessarily in small hard lumps. In order to pulverise these lumps so that the ore may be evenly acted on by the heat in the furnaces, a mill is commonly used; probably the same style of mill was used in Eastern countries two or three thousand years ago. It consists of a large circular stone through which a wooden axle passes; the stone is about 5 feet in diameter and 2 feet thick, standing on edge; it revolves around near the outer end of the axle, which is drawn around in a circle of about 25 feet in diameter by a mule attached to its outer end. The pulverised ore is dark grey, but when sufficiently acted on by the heat in the furnaces it assumes a dull red colour. A very simple test is necessary to ascertain when the ore is sufficiently roasted; a small quantity, after being allowed to cool, is held in the hand and dipped into water, a considerable quantity of heat will be evolved but not nearly as much as in the slaking of lime. The magistral is of a painfully disagreeable odour and the particles are so fine that the slightest movement stirs them up, consequently the workmen while spreading it over the tortas have to tie cloths over their mouths in order not to inhale the particles. The quantity of magistral required may amount to 2¼ per cent. and if pure sulphate of copper is used the quantity required rarely exceeds one-fourth per cent.

Immediately after the sulphate of copper is mixed into the torta, quicksilver is added, about 1½ lbs. for each "mark" (8 ounces) of silver the mass contains; more quicksilver is added from time to time until the whole amounts to about 3 lbs. per mark. The quicksilver is added to the mass by being strained through canvas. It is first weighed and distributed around the torta in the common iron quicksilver bottles: several workmen are each provided with a square of good thick canvas; a quantity of quicksilver is poured into each square of canvas, the four corners being held by the workman, thus making a bag which he swings about him as he walks over the torta; the quicksilver is thus spread over the torta in very minute particles.

It requires a very considerable amount of absolutely necessary experience to manage the reduction of these ores by this process. If sufficient salt is not used the whole of the silver will not be extracted; if too much, the excess of salt is a loss and salt was not a cheap article in Mexico before the advent of railways; if sufficient sulphate of copper is not used the silver will not be extracted at all, or at best, only what native silver the ores may contain will amalgamate with the quicksilver; and if too much sulphate of copper is used a serious loss of quicksilver is the result, although this mistake may be counteracted to a great extent by the judicious use of some common ashes or quicklime, or better still, a small quantity of precipitate of copper; but should the quantity of sulphate of copper be far in excess of the quantity required the result will not only be an irretrievable loss of a large quantity of quicksilver but the process will be retarded for an indefinite length of time.

Six to seven men are required to attend to the torta while it is being mixed by the horses; their duties consist of applying the salt and other ingredients as ordered; of adding sufficient water to keep the torta at a proper consistency, otherwise the heat of the semi-tropical sun would soon dry up the mass; to throw back with flat wooden shovels the edges of the torta as they spread under the feet of the horses, and to bathe the horses every day when their work is finished. If this were not done the mud carried away by the horses would be a very serious loss. Each set of horses is bathed in a temporary bath constructed by the men adjacent to the torta: the whole of this bath is distributed over the torta the next time it is under treatment.

From time to time a trial, called a "tentadura," is made to ascertain the condition of the torta. This tentadura consists of washing carefully in a black saucer or gourd a large handful of the mud gathered evenly from every part of the torta. The globule of quicksilver obtained by washing should be covered with a gray scum, and the residue of sand should have a rim of fine gray particles of silver and quicksilver; these will gradually disappear, and the quicksilver will become more and more dense as it amalgamates with the particles of silver. When the tentadura shows that all the silver has become amalgamated, this part of the process is complete.

The chemical action that takes place is, I believe, somewhat as follows: the sulphate of copper acting on the salt liberates muriatic acid, which acts on both the quicksilver and on the chlorides of silver contained in the ores and these through what is termed "electro-chemical" action combine, making the amalgam or form in which the mercury and silver now appear.

The mud is now carried, usually in primitive hand-barrows, to be washed in a large tank constructed for the purpose. This tank is usually about eight feet square, and three feet deep; a small stream of water is kept constantly flowing into the tank and from one to four men stand in it bare-footed and bare-legged who keep stirring the mud up in the water with their feet. The particles of mud are carried away with the water leaving amalgam only at the bottom of the tank; quantities of amalgam and light particles of silver and mercury are also carried away with the water, but these are caught in long continuous launders constructed with ridges and with troughs at intervals. Some quicksilver is poured along the launders before the washing begins with which the floating particles of silver and quicksilver will unite. Boys, bare-footed, are employed moving up and down in the launders to prevent the heavier particles of the mud from settling in the form of sand, as in this case the particles of silver would pass over the sand without coming into contact with the quicksilver.

When the washing is completed the amalgam is emptied into a long conical bag made of extra-thick canvas. About 75 per cent. of the mercury will oose through the canvas in practically a pure state which is caught in receptacles usually made of raw-hide supported on frames of wood. A very thick dry amalgam is left in the bag; this is packed solidly in triangular bricks; these bricks are carefully built into a circular prism 18 inches in diameter, leaving spaces between the bricks, on an iron rack standing over an iron cup through which a small stream of cold water is made to run and to discharge into a tank. A large iron cup, called a "campana" or bell, is then placed over the prism, its lower edge is carefully cemented to the floor with bone dust and ashes. An open dry wall of fire-bricks is built around the bell at about one foot from it and a fire of charcoal in this space is kept at white heat for about 12 hours. The fumes of quicksilver coming into contact with the stream of cold water are immediately condensed into quicksilver, which is caught in the tank into which the stream of water discharges. After being allowed to cool, the bell is lifted off, the prism of silver is now found in a very porous form and much reduced in size; it is broken up and cast into bars of about 120 marks (60 lbs) each and in this form it is sent to the Mint. Nearly the whole of the silver contained in the ores is extracted by this process and in a very pure state, and the entire loss of quicksilver amounts to about 12 per cent. of the quantity employed.

The water after leaving the launders above mentioned discharges into a large tank of masonry where the heavier portions of the mud (tailings) are allowed to settle. This is concentrated in a very primitive manner and when a sufficient quantity has been concentrated from a number of washings it is re-ground in the arastres, spread into a torta and treated in precisely the same manner as above described.

This process, as I have before stated, requires about a month and is well adapted to a warm country and where only animal power is available. A similar result is obtained in 24 hours by placing the finely ground ores with the necessary salt, sulphate of copper and quicksilver, in barrels which are constantly kept revolving by steam, water or other power, but the resulting amalgam is frequently charged with a very undesirable amount of iron, copper or other metals, thus making the subsequent process of purifying the silver very expensive.

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PERMANENT STREET PAVEMENTS: THEIR DURABILITY AND COST.

By J. W. TYRRILL,

O. L. S., C. E., Hamilton.

THESE are not the only characteristics to be considered in order to be able to arrive at a wise solution of one of our most urgent municipal questions of to-day, namely: "What description of pavement should we adopt?" but they are certainly two of the most important.

Other considerations should be, cleanliness and sanitary conditions, resistance to traction, foot-hold afforded for horses, facilities for removal and repair, amount of noise created, and appearance; but as a volume of no small proportions would be the outcome of an exhaustive paper upon the whole subject of permanent street pavements, we will confine our remarks at this time to the questions of durability and cost.

WOODEN PAVEMENTS of various designs have been tried in many of our cities, but they have failed to give satisfactory results, and most grievously so, upon streets of very heavy traffic. In any case, wooden pavements have proved to be most expensive luxuries on account of their necessity for constant repair and frequent renewal. They have, however, served a purpose in educating us to the point of realizing the necessity of something a step farther in advance. Wooden block pavements have, beyond doubt, some admirable qualities possessed by few, if any other pavements; but, upon the whole, experience in this country has proved them to be sadly lacking in many important respects. We will not make further mention of wooden pavements, as they do not properly belong to the subject of this paper.

Neither will we take into consideration MACADAM OR GRAVEL PAVEMENTS, for, though when properly constructed and cared for, they are well adapted to the requirements of many localities, they are not suitable or economical upon city streets of comparatively heavy traffic, and it is for such streets especially that we shall endeavour to reach a solution of the question.

It remains for us, therefore, to make our selection from pavements constructed of STONE BLOCKS, of BRICKS, or of ASPHALT.

The *durability and cost* of a pavement are in a sense inseparable characteristics, from the fact that the annual cost necessary to perpetuate a pavement depends largely upon the durability or number of years the pavement will wear; and also from the fact that a pavement of inferior durability, requiring constant repair and frequent renewal, is an abominable nuisance to the travelling public, and the cause of serious loss to local business.

Durability is of itself, therefore, a quality of the greatest importance, and, consequently, with the object of arriving at some reliable comparison between a number of available paving materials, the following experimental tests were made by the writer:—

THE SPECIMENS. The specimens procured for the tests were as follows:—

No. 1. Grey Aberdeen Granite. Two small pieces, weighing about four pounds, were procured from local dealers. I endeavoured to obtain a piece large enough from which to have an ordinary granite block, such as is generally used for paving purposes, cut, but was unable to do so.

No. 2. New Brunswick Red Granite. Of this a roughly-squared block about half the size of an ordinary paving sett was used.

No. 3. Stanstead Grey Granite. This sample was a roughly-squared block about $6'' \times 5'' \times 1\frac{3}{4}''$. It was of much finer grain than the New Brunswick granite, but much similar in appearance to those from Aberdeen.

Nos. 4 and 4A. Hamilton Limestones. These were two specimens obtained from quarries in the neighborhood of Hamilton ('4' from Mr. Galagher's quarry, and '4A' from Mr. Handcock's). They were roughly dressed to the form of rectangular blocks. No. 4 was of a dark steely grey colour, and '4A' was of a lighter bluish grey.

No. 5. Hamilton Freestone. This specimen was a rectangular block, $8'' \times 6\frac{3}{4}'' \times 3''$, but, judging from its sad experience under test, I am inclined to believe that it could not have been a fair sample.

No. 6. Hamilton Vitrified Brick. This brick was furnished me by Mr. Campbell, of the Hamilton and Toronto Sewer Pipe Company, and was said to have been manufactured from Hamilton clay by that Company. The brick measured $8\frac{1}{2}'' \times 4'' \times 2\frac{1}{2}''$, and was of a dark, reddish brown colour. Sixty-one of them laid on edge would make a square yard of pavement.

No. 7. Hamilton Sand Brick. This was a sample brick manufactured from Hamilton sand and Hamilton cement, but made in the United States by some patented process. It was a handsome-looking brick of a brownish colour, resembling a good deal in appearance Credit Valley stone. It was not recommended to me as a paving brick, being manufactured only for building purposes.

No. 8. Hamilton Common Hard Brick. This was an ordinary hard building brick.

No. 9. Metropolitan Block. This block is manufactured in Canton, Ohio. The several samples, which were expressed to me upon application, were of exactly the same size, measuring $9\frac{3}{16}'' \times 3\frac{13}{16}'' \times 3\frac{3}{16}''$. It is a very handsome specimen of a repressed brick, having smooth surfaces, rounded corners, and being of a chocolate brown colour. The rounding of the corners, it is claimed, prevent the edges from becoming chipped by the pounding of the horses' shoes, and also affords good foothold. The blocks are exceedingly hard and fracture with a smooth surface, being thoroughly vitrified. In the process of manufacture they are brought to a white heat and kept in that condition for six days. Forty-four blocks will lay one yard of pavement, and their cost, delivered at cars for shipment, is $14.00 per 1000.

No. 10. Imperial Block. This specimen was virtually the same as the Metropolitan Block, with the exception of being smaller, it only measuring $8\frac{1}{4}'' \times 4\frac{1}{8}'' \times 2\frac{1}{2}''$. It, and the block just described, are manufactured in Canton, Ohio, by the same Company. Sixty-five of these would lay one yard of pavement, and they are delivered at cars for shipment at a cost of $10.50 per 1000.

No. 11. Vitrified Brick, also from Canton, Ohio, and the manufacturers of the last two numbers; but in appearance it is a very different brick from either of them. It is not what is known as a repressed brick, and is much rougher looking. Its corners are not rounded, and it breaks with a rougher fracture—not being so highly vitrified. Its colour is of a dark reddish brown. Size, $8\frac{1}{4}'' \times 4\frac{1}{8}'' \times 2\frac{1}{2}''$, and cost, delivered at cars, $9.50.

No. 12. Hallwood Block, from Columbus, Ohio. This block is of peculiar construction, and is patented by the makers. It's dimensions are $9'' \times 4'' \times 3''$. It is made by the re-press process, and is finished with glazed surface, which feels decidedly oily to the touch. The angles are rounded off slightly more than those of the other repressed blocks above described, and passing longitudinally around the block are two grooves, which, it is claimed, give additional strength to the joints of the pavement. Forty-four blocks lay a yard of pavement, and their cost at cars is $18.00 per M.

No. 13. Vitrified Brick, also from the manufacturers of the Hallwood Block. The sample was a large brick, measuring $9'' \times 4\frac{5}{16}'' \times 2\frac{7}{8}''$, but inferior to the block, being only once pressed and of rougher appearance, with sharp angles. Price, $12.00 per M.

No 14. Fire Brick, from New Brighton, Pa. This was the only specimen of fire brick received. It was of a light buff colour; measured $8\frac{3}{8}'' \times 4\frac{1}{8}'' \times 2\frac{3}{8}''$, and was of the single pressed description, with square angles.

No. 15. Dry-pressed Building Brick. This sample, with a variety of other very handsome building bricks, was kindly furnished me by Messrs. Taylor Bros., of the Don Valley Brick Works, Ontario. It was subjected to my tests out of curiosity to see how it would compare with the vitrified bricks, rather than with any expectation that it would be suitable for paving purposes. I might just remark here in this connection, that Messrs. Taylor Bros. are at present putting up a new plant for the special manufacture of paving bricks.

Having collected the above fifteen varieties of paving materials, the weight of each specimen was carefully noted.

The use of an ordinary cast-iron "rattler," such as is commonly used in foundries, was then procured, and the specimens—together with about two hundred pounds of coarse shot and small scrap iron placed therein.

The rattler, or cylinder, which was about two feet six inches in diameter by four feet in length, was then given 500 revolutions at the rate of about twenty turns per minute, and the sample taken out and again weighed. The object of this first rattling was merely to reduce all specimens as nearly as possible to the same condition, preparatory to receiving a second and severer test. More iron was then placed in the rattler with the specimens, and pieces of larger size and greater weight. The broken castings, for firepots of stoves, and sharp angular pieces, varying in weight from 5 to 15 pounds, were made use of.

The cylinder was then given 1,500 additional revolutions, after which the surviving samples were again taken out and carefully weighed.

I may just mention here that this was the second time that I had performed these tests. In the first instance the per centage of loss in the granites was remarkably small, as I had depended upon the samples themselves, and the iron shot, to produce the wear. But, in considering the matter afterwards, it occurred to me that this would not be a fair test, for the softer samples would be reduced by the harder ones, but the hard ones would be but little affected by the hammering of the softer ones. Therefore, I repeated the tests with the addition of the scrap iron, as above described, with the result that the loss of weight of the granite was increased 700%, whilst the increase in the loss of the bricks was not more than 25%.

I have, therefore, adopted the second tests for the purposes of any comparison, excepting when otherwise noted. Tables numbers 1 and 2 have been prepared, shewing the results of my experiments.

In table No. 1 the first column gives the numbers of samples for convenience of reference, and the letter A affixed means a second sample of same material.

The second column gives names of the specimens and places where manufactured, or from which obtained. The 3rd, 4th and 5th columns give the weights noted before and after each rattling. The 6th, 7th and 8th columns give the percentage of loss of the original weight in each case, but it is upon the figures given in the 7th column that I have based my estimates of durability, as they represent more fairly the comparative loss under similar conditions than the next table, giving total losses. And in the ninth column is noted the mean losses of specimens in second rattling, when two samples of the same kind were used.

In table No. 2 the surviving (I say surviving because in some cases the specimens were hammered out of existence) specimens are rearranged in the order of merit. In the second column are given the comparative losses in terms of Aberdeen granite; and in the third, the estimated life of pavements constructed from the various materials tested. My reason for adopting Aberdeen granite as my standard of comparison is, not that it possesses any special merit or superiority over many other granites, but because it, having been in use in the city of London and elsewhere for a great many years, experience has taught us what its capabilities of endurance are. Although, when we attempt to seek for records of the *amount of wear* for a *certain traffic*, even for this extensively used paving material, it is remarkable how scant such information appears to be. There is no trouble in finding records of the amount of wear of a pavement on a certain street in a given time; for instance, we are informed by various authorities, that on Blackfriars Bridge, London, setts of Aberdeen granite wore down one and a half inches in thirteen and one-fourth years, and that Guernsey granite wore only one-fourth of an inch in the same time, but the amount of traffic passing over the pavement is not given. The information is only valuable, therefore, to show the *relative* durabilities of the two stones. We are also informed of the results of Mr. Walker's experiments with several varieties of granite setts, which he placed under heavy traffic for a period of seventeen months; but, again, no idea of the weight of traffic, producing the results noted, is given, from which could be estimated the lives of the pavements for different degrees of traffic.

Though I have searched eleven or twelve authorities upon street pavements, the best information to the point that I have been able to find is given by A. T. Byrne. On page sixty-eight of his valuable book upon Highway Construction, published in 1892, he states that "On London Bridge, which has a traffic of over 15,000 vehicles in twelve hours, the wear of granite blocks has been found to be at the rate of .222 of an inch per year, or that the number of years required to wear away one inch, is four and one-half." Even in this case the description of the granite is not given—though it is doubtless the Aberdeen stone, as it is used now almost entirely in London—nor is the width of the bridge. It would evidently make a very great difference whether the 15,000 vehicles passed over a width of thirty feet, or were distributed over a width of say seventy-five feet. However, I have—without going over to measure it—been able to discover the width of the bridge which is given in the Encyclopedia Britannica as being 53 feet between the parapets. This would probably mean thirty-three feet—room for four vehicles, in the centre, and a foot-walk of ten feet on either side. Working upon this assumption, we have the amount of traffic on London Bridge as 1,364 vehicles per yard of width per day of twelve hours, and it has been observed that under that amount of traffic granite blocks have worn down to the extent of 222 of an inch in a year. From what has thus actually been observed to take place, it is a simple matter of calculation to determine what should be the amount of wear for any given traffic, and thus to determine the life of the pavement for that traffic.

In order to apply this theory to practice, I have kept count for several days in succession and ascertained the amount of traffic upon two of the principal streets of Hamilton—James and York streets.

The number of vehicles passing on either street was found to be about the same, being 135 per yard of width per day of 12 hours—exclusive of portion of street occupied by street railway tracks.

Upon James streets about 82% of the traffic was observed to be light, the remaining 18% being medium and heavy; but on York street the percentage of medium and heavy was about 35 of the whole.

As we have, however, no information as to the character of the traffic upon London Bridge, we will disregard that consideration, and deal also only in numbers of vehicles.

Now, if the wear for a traffic of 1,364 vehicles per yard of width per day has been found to amount to .222 inch, the amount of wear for the same pavement (granite) for a traffic of 135 vehicles would be .022 inch ; or, for the traffic of James and York streets, it would require in order to wear the pavement down to the extent of two inches, a period of 91 years, which would represent the life of the pavement for those streets ; for experience has shewn that by the time stone block pavements have become worn to the extent of two inches they require to be taken up, though after being dressed they may be relaid.

Then, assuming that the durability of the pavement is proportioned to the durability of the specimen tested—and I think this should be a fair assumption—we can readily calculate what should be the life of each pavement constructed of materials such as our samples. For example, the wear of Aberdeen granite being taken as 1, that of a specimen of Vitrified Paving Brick, made by the Hamilton & Toronto Sewer Pipe Company, was found to be 1.44 ; therefore, the life of the brick pavement should be $\frac{1}{1.44}$ of that of the granite, which would amount to 63.2 years. In this way the lives of pavements constructed from such several materials as tested have been computed and noted in table No 2. It may be remarked by some, that in the estimates of durability thus obtained no account has been taken of the influences of the weather ; but it will be readily seen that this is not the case.

Whatever effect the weather or atmosphere may have upon the granite pavement, such effect will be applied to each of the other pavements just in proportion to the wear of the specimen in the rattler test. For example, the influences of the weather upon the granite would be multiplied by 9.93 in the case of the common hard brick ; that is, my estimates of durability include the assumption that the common hard brick would be affected by the weather to the extent of about ten times that of the Aberdeen granite.

This would probably closely represent what would actually take place, so that, with perhaps the exception noted in the table, I think we have good reason to believe that the durability of pavements estimated as above described, and as noted in table No. 2, should be attainable in practice.

By way of supporting this opinion, I will again quote from A. T. Byrne, who says that "Brick has been used for upwards of a hundred years in the Netherlands, and pavements laid half a century ago are still in good condition. There are several brick pavements in the United States from ten to eighteen years old, which are still in good condition."

ASPHALT. As to the durability of asphalt pavements, experience has shewn that their life is not by any means proportional to the traffic they sustain. In fact, even an extremely heavy traffic appears to produce scarcely any perceptible wear.

An asphalt pavement in Cheapside, London, after fourteen years traffic of 13,772 vehicles per day having passed over it, was found to have been reduced in thickness by only seven-eighths of an inch, and this reduction was chiefly due to compression.

Another asphalt pavement, which has sustained a very heavy traffic for sixteen years in the city of Paris, was found when taken up, to have lost only five per cent. of its original weight, though twenty-five per cent. of its original thickness. Some of the streets of London, carrying the heaviest traffics of any streets in the world, have been paved with asphalt and been in constant use for from 16 to 19 years before having been renewed. Similar pavements, sustaining very much lighter traffics, in other cities in England and America, have exhibited no greater powers of endurance, so that I think we may reasonably agree with Mr. Haywood, who, as Mr. H. P. Bulnois, City Engineer of Liverpool, informs us, places the life of a good asphalt pavement at seventeen years —and as it appears, irrespective of the traffic it has to sustain.

Conclusion. With regard to durability we are, therefore, bound, from the foregoing, to draw the following conclusions namely : that for extremely heavy traffic such as exists on some of the streets of great cities, asphalt stands far ahead even of granite blocks ; but that for streets of somewhat lighter traffic, say 700 vehicles per yard of width per day and less, granite blocks would give better results, and for more ordinary traffic, of say 500 vehicles per yard of width per day and less, a good quality of vitrified brick pavement should give excellent results, and be preferable to asphalt.

Cost. As to the cost of pavements, I cannot do better than simply give a table of the prices which have been paid during the past few months for different pavements in various places in this country and in the United States.

The following table, giving the first cost only of work, has been compiled chiefly from the contract prices reported from time to time in the *Engineering News :*

LOCALITY.	COST OF BRICK.	COST OF GRANITE.	COST OF ASPHALT.
Anderson, Ind	1.73		
Avondale, O	2.53 to 2.80*		
Burlington, Ia	1.53 to 1.65		
Buffalo			3.00
Chicago	2.00	3.13	
Detroit	2.80		2.78–2.85
Huntingdon, Pa	1.80		
Montreal, P. Q			3.43–3.97
Moberly, Mo	1.35†		
New York		2.50–4.50*	3.25–4.50
Philadelphia			2.50
Rochester	2.25*		
Toronto		3.00–3.80	2.50–3.00
Wilmington	1.98–2.26		
York, Pa			2.13–2.97

* Concrete foundation.
† Sand foundation and exclusive of grading and curbing.

It would now be interesting and instructive from the above figures of the cost, and my table of comparative durabilities, to make out a table of annual costs necessary to perpetuate the different pavements for various degrees of traffic, but in preparing this paper I have not had the time to devote to this. Anyone who may be sufficiently interested can, from the data furnished, make these calculations for himself, or I may have an opportunity of taking up the subject again at some future time.

TABLE No. 1. (7 A)

TABLE GIVING LOSSES OF SAMPLES OF PAVING MATERIALS SUBJECTED TO RATTLER TEST.

No.	Name and Locality.	Weight in Ounces.			Percentage of Loss.			Means of 2nd.	Remarks.
		Original	After 500 turns.	After 2,000 turns.	In 1st.	In 2nd	Total.		
1	Grey Granite from Aberdeen.	32.75	32.50	31.25	.76	3.81	4.58	3.06	Slightly worn.
1 A	" " " "	32.50	32.00	31.25	1.54	2.31	3.85		
2	Red Granite from N. B......	66.75	66.25	65.00	.75	1.84	2.62	1.84	" "
3	Grey Granite from Stanstead	69.00	68.50	67.50	.72	1.45	2.17	1.45	" "
4	Limestone from Hamilton....	91.00	90.00	87.00	1.10	3.30	4.40	.....	Broke at "dry."
4 A	" " "	204.00	199.50	192.50	2.21	3.43	5.64	3.37	Worn smooth.
5	Freestone from Hamilton....	190.00	171.50	....	9.74	......	......	.....	Broken to fragments.
6	Vitrified Brick from Hamilton	113.00	107.00	102.00	5.31	4.42	9.73	4.42	Corners evenly worn.
7	Pat'd Sand from Hamilton...	110.00	96.00	....	12.73	......	......	.....	Ground to powder.
8	Common Hard Brick Hamilton	77.30	57.50	34.00	25.61	30.40	56.01	30.40	Broken and worn evenly
9	Metropolitan Block, Canton, O.	159.50	156.00	144.50	2.19	7.21	9.40	.....	Spalled. Not worn.
9 A	" " "	161.30	155.50	146.00	3.60	5.88	9.48	6.55	" " "
10	Imperial Block, Canton, O...	115.50	114.00	108.00	1.30	5.19	6.49	.....	" " "
10 A	" " " ...	112.50	103.00	98.50	8.44	4.00	12.44	4.60	Fractured in 1st test.
11	Vitrified Brick, Canton, O...	113.00	108.00	103.50	4.42	3.98	8.41	3.98	Evenly worn on corners
12	Hallwood Block, Columbus, O.	137.50	131.00	124.50	4.72	4.72	9.44	4.72	" " "
13	Vitrified Brick, Columbus, O.	139.50	136.50	124.00	2.14	8.97	11.11	8.97	Chipped and worn.
14	Fire Brick, New Brighton, Pa.	103.50	99.50	91.00	3.87	8.21	12.08	8.21	" " "
15	Pressed Building Brick, Don.	97.50	77.00	50.00	21.03	27.69	48.72	27.69	Fractured and worn.

Table No. 2.

Names and Localities in Order of Merit.	Loss in Terms of Aberdeen Granite.	Life of Pavements for a Traffic of 135 V. per yd.
Grey Granite from Stanstead.......	.47	193.6 years
Red Granite from N B..............	.60	151.6 "
Grey Granite from Aberdeen........	1.00	91.0 "
Limestone from Hamilton...........	1.10	*82.7 "
Vitrified Brick from Canton, O......	1.30	70.0 "
Vitrified Brick from Hamilton, Ont..	1.44	63.2 "
Imperial Block from Canton, O.....	1.50	60.7 "
Hallwood Block from Columbus, O..	1.54	59.1 "
Metropolitan Block from Canton, O.	2.14	42.5 "
Fire Brick from New Brighton, Pa...	2.68	35.0 "
Vitrified Brick from Columbus, O...	2.93	31.0 "
Pressed Building Brick, Don........	9.05	10.0 "
Common Building Brick............	9.93	9.2 "

* This estimate is probably too high, as experience tends to show that limestone does not wear well as a paving material.

DISCUSSION.

Mr. Dickson—What is the asphalt composed of?

Mr. Tyrrell—I am speaking there of Trinidad asphalt. Of course it is not used in its natural state; it is mixed with oils to bring it to its proper consistency.

Mr. Abey—I may say in reference to those vitrified paving bricks. I put some of them in water for 36 hours, and they absorbed about half an ounce of water in that time. They are very hard; quite as hard I think as granite. The ordinary brick such as we use for sewers will take in a pound or two of water.

Mr. Chipman—In speaking of the relative values of the different pavements, I think there was one matter that was not taken into account in determining the value, that is, the sanitary aspect of the question, and I may be pardoned, perhaps, for drawing the attention of the Association to it. It is something that should not be overlooked in my opinion. A wooden pavement should never be laid in any city, especially in large cities. I believe that the brick is the coming pavement.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

THE EDUCATION OF OUR DRAUGHTSMEN.

By F. L. FOSTER,

O.L.S., Toronto.

As the subject of the early training of the students of our profession has, I think, not been touched upon, or at all events, not treated of to any extent in our discussions and reports hitherto, and having been requested to contribute a paper for this meeting, I have ventured to choose the topic of education with special reference to draughtsmanship, in hopes of its being followed by contributions from other members, giving their views regarding the other branches of training, so desirable in forming the finished practitioner.

In answer to the possible question, "of what practical use is this subject, seeing that we have Schools of Technology, and Universities to teach all that is required in this connection?" I will say that many of our students at a distance from centres of education have not an opportunity of benefiting by these institutions, and to such, some practical hints may be useful.

The utility of a certain amount of artistic training for our students will, I think, be readily conceded by at least some of the veterans of our profession, when referring to their field-notes, plans and sketches of old but important surveys; and many a strong expression of regret has been uttered that they had not been more carefully instructed when young, in the art of note-keeping and sketching.

It goes without saying that good and useful field-notes must be taken clearly and legibly, but the application of the artistic faculty is not so apparent.

The knowledge of the most rapid and correct methods of conveying to the senses the appearance of objects by a few strokes of the pencil, is to my mind, an acquisition worthy of much study and practice, enabling one as it does, to note facts and figures, ideal as well objective, in the best and most convenient form. It is the shorthand method of the artist, and will serve the purpose of the surveyor and engineer just as well.

The practical application of this knowledge may be illustrated by supposing an exploration survey to be in progress for the location of a railway line.

How much more rapidly taken, and perfect will the notes of the location engineer be, when sketched by means of the artistically trained eye and hand.

From any suitable points on his exploration lines he can make rapid sketches in any required direction, and by adding approximate heights and distances to the points in his sketches, can in a short time record all necessary information, both in plan and perspective view—

In taking notes of most, if not all kinds of surveys, this knowledge can be usefully applied.

The fundamental rules and principles of geometrical and isometrical perspective should be taught the student of surveying or engineering, and the rapid estimating of angles and distances as well as the judgment of proportions between objects should be frequently practised, so as to give facility in placing the shape, apparent size and approximate position of these objects rapidly on paper by a few strong and firm outlines. The knowledge thus attained is the ground work or basis of the most important part of every artist's education: and it is principally by the out-door study of the outlines and interior structural lines of natural and artificial objects, more, perhaps, than to their light, shade and colour, that he gains the power of transmitting his views of the character of each object to his paper.

We all know how much expression can be given by a few lines, but the power of doing this is only attained by careful study and considerable practice.

The trained eye will see more in an object than that of one unused to sketching, because of the frequent observation with a view to transmitting objects to paper. This training also improves the memory so much that objects, and even scenery of a complicated nature, can be readily recalled and sketched with a fair amount of accuracy many years after being seen.

The utility of the photographic camera, although very great, cannot obviate the necessity or desirableness of the training just mentioned.

Successful photographs require conditions of light and atmosphere not necessary to the sketcher. The camera, we know, records all in view—the sketcher, only the few objects which he may require. In fact, so widely do the two methods of recording objects differ, that a comparison is obviously unnecessary; however, the fact that an instrument like the camera can be used for so many purposes in the practical work of surveying and engineering, with such a little expenditure of skill, or even thought, should not, I think, prevent our students from cultivating the artistic faculty, for by doing so they develop latent possibilities that cannot but be a benefit to them, apart from their strict application to the duties of their profession.

In conclusion, I wish to state my opinion, that the subject of draughtsmanship has never had the attention it deserves from our Board of Examiners, and that as the power is in their hands to compel the attention of students to this necessary branch of education, the subject should be placed on the list of requirements, from the candidates for final examination. I think that a knowledge of the rules of perspective drawing should be required, and that a fair proficiency in free-hand lettering, and whatever constitutes the Topographical Draftsman's Art, should be shewn and tested by the construction of finished plans from given field-notes in a stated period—say one day during the progress of the examination.

By means of these requirements, students would necessarily educate themselves accordingly, and a corresponding benefit to the profession would in time undoubtedly follow.

DISCUSSION.

Mr. Niven—The suggestions thrown out, I think are worthy of consideration. So far as the Board of Examiners are concerned, of course that is one of the subjects, but it has never been looked at in the way that Mr. Foster suggests. I think the suggestion is a good one, and I shall have much pleasure in bringing it before the Board at their first meeting.

Mr. Morris—A better knowledge of drawing would give to the surveyor a means of giving information that to many is not now possible. So many of us have to appear before the judges of the province to give information as to questions in dispute, that very often the surveyor not in a position to show in some artistic way, a rolling country, or a country diversified with water is at a disadvantage, and experts who are called in sometimes, throw the surveyor in the shade: so that if we were in a position to give this information in explanation of our notes, it would improve our standing very much.

Mr. Winter—It strikes me very forcibly that if there is to be any move made towards getting a topographical survey of the country, it is a matter of very great importance indeed, that our young surveyors coming into the profession now should be equal to the occasion. At all events we should not be content to sit down and make no progress. The country is progressing and the world as well, and we ought to keep up with the age.

Capt. Gamble—I feel that Mr. Foster has expressed in his paper almost everything that need occupy our attention. As he suggested, a day or half a day might be given at the examination to a practical exhibition of the students' ability in that direction. It is a very different thing I think for a man to be able to plot correctly from field notes in a short time, to sitting down and preparing a map, which most people can do if you give them time enough. The examiners should have an opportunity of seeing what facility a young man possessed as to expressing himself on paper in short time. I think this is a very important thing. And as Mr. Winter has just said, should we be instructed either in the near or distant future, to make a topographical survey of the Province of Ontario, it would be very necessary that we should have many who would be properly instructed in the art.

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THE TRANSIT, AND HOW TO USE IT.

By CYRUS CARROLL,

O.L.S., C.E., Hamilton.

I SHALL endeavour to confine my remarks to such ideas and knowledge as I have gained in an experience of over thirty years, avoiding as much as possible anything you may find in books concerning the Transit.

In the first place, let us consider the tripod. This should be good and strong, the wood tops of legs at least 2 in. square, in correspondingly large brass bibles, the bolt to have washers and thumb-nuts, to be relaxed every time the legs are folded together. I once bought an imported transit for $225. The tripod was much the same as is used with English Dumpy-levels—small top, small brass bibles, and brass ends of legs fitting between them. It worked well in the office, and for a few days in the field, after which it was unsteady. This was not annoying to the maker nor to the dealer, but was decidedly inconvenient on the plains of Manitoba, 500 to 1,000 miles from an instrument repairer.

In a triangulation with a good instrument I found the resulting triangles generally 3′ short of 180° in the 3 interior angles. This was the experience of Mr. H. Munro McKenzie, Mr. John Robinson, Mr. C. W. Biggar, Mr. Marcus Smith, and other eminent engineers.

In the imported instrument the plumb-bob was suspended from a hook rigidly fixed into the tripod-head, and extending 4″ down. I had of course to remove the hook.

As to the instrument itself, there is no need of having a great quantity of metal. The weary transit-man has weight enough to carry in any case. Light, well made transits are the best. My own predilection is for 6′ limb, inside verniers splayed both ways, reading to 15 or 20″, Verniers marked A and B.

Graduation one way zero to 360°, *i. e.* to the left ; an inner numbering zero to 180° to the right. This will be of great use in setting out curves to the right, as it saves a very laborious and awkward figuring out of the Tangential Angles, which must be done with an instrument reading only one way. But should you have an instrument reading only one way, I would say so choose your first sight that in turning off your angle you can read it direct. Avoid any manner of working by which you have to figure out results, not so much on account of the labour involved, but chiefly, because by so doing you increase the chances of error.

Have the compass-card read 0 to 90 degrees each way from north and south, for the same reason. A card reading 0° to 360 is a first class nuisance

Have the axle boxed in tight. Never buy an instrument with the axle in wyes, to separate in boxing up. If you use such a transit three weeks in succession in hot weather the small rubber tips over the axle will give out. Then the axle will rise and ride in the wyes. Do you say you would prevent that by packing it down? Well, perhaps you would, and perhaps you would not. Generally speaking in such a case you have to interview the instrument-maker—perhaps 1000 miles away—while you have a party on your hands, say eight men at round wages, eating your pork that stands you 40 cents a pound, and grumbling at its flavour. Instrument makers do not care about these things, but you do.

In chosing an instrument, see that the tube travels truly in line. In my imported instrument, the tube was drawn only—not bored out; the wires wobbled off the line in fixing the focus for long and short sight. Vertical circle should be not less than five inches, with two verniers, reading to minutes.

All tangent screws should have compensation springs to even the motion and prevent jumping.

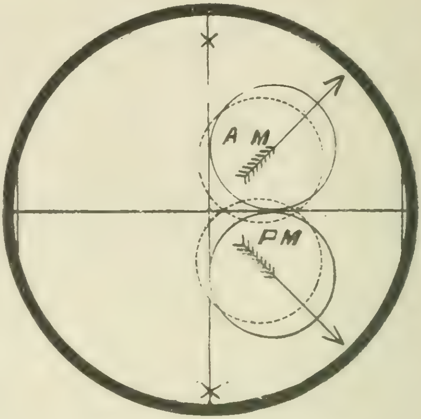
You may make a very useful michrometer by placing vertical spider's lines as near the outside of the tube as you can see a small portion of them, one on each side. Set up your instrument on a level piece of ground and measure say 1,000 feet straight away from its focus, then place a picket very carefully in line of each of these outside wires, the line joining pickets of course being at right angles to the line from transit. Suppose the distance between centres of pickets is forty feet; $1,000 \div 40 = 25$, which is your scale; that is to say, one foot in width for every twenty-five feet length of base. It follows that if we measure the distance between centres of pickets within one inch, we have the distance within twenty-five inches. If we measure it within one-fourth of an inch, which we can, then we have the distance within six inches.

In crossing quaking bogs or deep beaver ponds it is much quicker and more accurate than direct measurement. It is doubly as correct as the michrometer which reads the vertical rod, on account of subtending double the distance. You have of course to find the true value of your scale, and so use it whatever it may be.

As you intend your transit to be fit for all uses that such an instrument can be put to, do not have any but horizontal and vertical wires.

The inclined or × wires cannot be used in observations of the sun for azimuth, as you must take the direction of the sun as well as its altitude at one observation. Besides the central vertical wire is useful in keeping the picket plumb.

In observations of the sun in the forenoon, use only the lower and following limbs, applying the semi-diameter of course to suit the case. In the afternoon use only the upper and following limbs.



The reason for always using the following limb, is that you can plant the vertical wire × × on the sun (as shown by the dotted line,) and take the observation the instant the sun quits the wire. You can always do this more accurately than you can place the wire ahead of the sun, and note the contact.

The lower and upper limbs are to be used in the forenoon and afternoon respectively, for the same reason, namely : that the sun is receding from under the wire, so that the last contact can be anticipated, and got and used more easily and accurately than can the first contact.

In the diagram, the arrows show the direction of the apparent motion of the sun at each observation.

With the fingers of the right hand on the horizontal tangent screw, and the left on the vertical tangent screw, the observer can so range the wires that the sun will pass off from them simultaneously. Having taken and read the vertical and horizontal angle, and noted them, take another observation—take several in fact—and, so far as practicable, with the same intervals of time between each.

The results can be easily worked out on the spot. All this is very convenient in practice, as it is done in the best part of the day.

The only objection I have to observations of the pole star, is the miserably, untimely hour of the night at which, for the greater part of the year, the observations have to be made. Often in desolate places, difficult of access, with the after long cold drive through bad roads, rousing up sleepy toll-keepers, porters, livery-men, etc.

It often happens, that within an hour's time of the elongation, or perhaps within a few minutes of it, a cloud obscures or covers the star, and the observation is lost.

The same thing may, and often does happen, for several nights in succession. If any other surveyor gets paid for all his work of this nature, I want to hear from him.

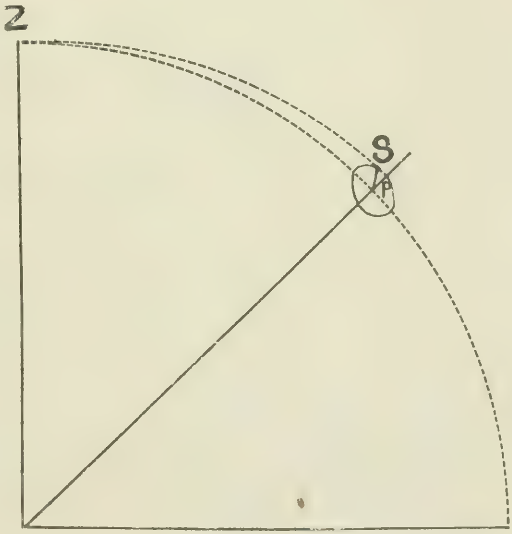
Now let us enquire whether it is necessary to lose the observation, if we have the instrument set up, and are following the star for an hour, more or less, before or after an elongation.

By calculating the azimuth, not only for the elongation period, but for intervals, from a few minutes to an hour before (and after) I find, that although there is a very perceptible motion of the star in azimuth, right up to the time of elongation, the amount of such motion in azimuth for the last few minutes, is very small—so small in fact, that it may be entirely neglected.

Also, that an error of five minutes in the time of observation, at about one hour from elongation, is only about half a minute of azimuth. This is the maximum error to be allowed for, and is equal to only nine inches in a mile, or say one inch in every ten chains; which is nearly always quite close enough for our work. But the error in the time need not exceed two minutes, which would reduce error in azimuth to less than one-fourth of a minute, say four inches in a mile. Let us therefore take our observations, if we choose, any time within an hour of the elongation. Will it be necessary to get special legislation to make this lawful?

While on the subject of the meridian, allow me for once to digress a little.

Cannot we surveyors make it necessary to have all our surveys give the astronomical bearing, and discard the "magnetic?" At present, bearings are mixed, confusing, and of but little use.



Let *Z* represent the Zenith, *Z P* represent the Co Latitude, *S* represents Polaris at five hours after Transit.

To find the Azimuth *SZP*—

We will assume the Latitude as 43° 39′ 40″ *N* that being about the mean of Toronto.

90°–lat. 43° 39′ 40″ = co lat $ZP = 46^\circ\ 20'\ 20''$ SP = polar distance per almanac 1° 15′ 28″.

The hour angle *SPZ* = 5 hours = 75° 0′ 00″.

Thus in the triangle *PZS*, we have given *ZP*, *PS*, and the included angle *ZPS*.

To find the Azimuth *PZS*:—

$$\begin{array}{lllr}
\text{Log secant} & \frac{1}{2}\, z\, p + p\, s & = 23^\circ\ 47'\ 54'' = & 10.038594 \\
:\ \text{“ cosine} & \frac{1}{2}\, z\, p - p\, s & = 22^\circ\ 32'\ 26'' = & 9.965488 \\
::\ \text{“ cotangent} & \frac{1}{2}\, s\, p\, z & = 37^\circ\ 30' = & 11.115020 \\
\hline
:\ \text{“ Tangent} & \frac{1}{2}\, z\, s\, p + s\, z\, p & = 52^\circ\ 45'\ 35'' = & 10.119102 \\
\text{Log cosecant} & \frac{1}{2}\, z\, p + p\, s & = 23^\circ\ 47'\ 54'' = & 10.394136 \\
:\ \text{“ sine} & \frac{1}{2}\, z\, p - p\, s & = 22^\circ\ 32'\ 26'' = & 9.583577 \\
::\ \text{“ cotangent} & \frac{1}{2}\, s\, p\, z & = 37^\circ\ 30' & 11.115020 \\
\hline
:\ \text{“ tangent} & \frac{1}{2}\, z\, s\, p - s\, z\, p & = 51^\circ\ 04'\ 17'' & 10.092733
\end{array}$$

$$\begin{array}{r}
\frac{1}{2}\, z\, s\, p + s\, z\, p = 52^\circ\ 45'\ 35'' \\
\frac{1}{2}\, z\, s\, p - s\, z\, p = 51^\circ\ 04'\ 17'' \\
\hline
1^\circ\ 41'\ 18''
\end{array}$$

That is to say, the Azimuth at one hour from elongation, is 1° 41′ 18″.

Now let us try fifty-five minutes from the elongation, using the same rule.

L sec 23° 47′ 54″ = 10.038594
" cos 22° 32′ 26″ = 9.965488
" cotan 38° 07′ 30″ = 10.105238

tan 52° 8′ 10″ = 10.109320

AND

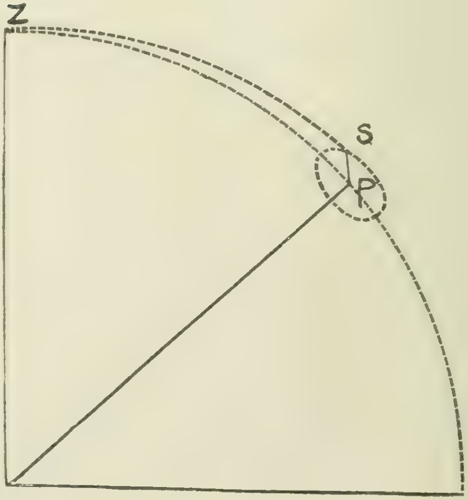
L cosec 23° 47′ 54″ = 10.394136
" sine 22° 32′ 36″ = 9.583577
" cotan 38° 07′ 30″ = 10.105238

∴ tan 50° 26′ 20″ = 10.082951

52° 08′ 10″
50° 26′ 20″

Azimuth 1° 41′ 50″ for 55 minutes before elongation.
" 1° 41′ 18″ " 1 hour " "

32″ difference of azimuth in 5 minutes of time.



This is about 9 inches in a mile, or say 1 inch in 10 chains; which is I think near enough for general use.

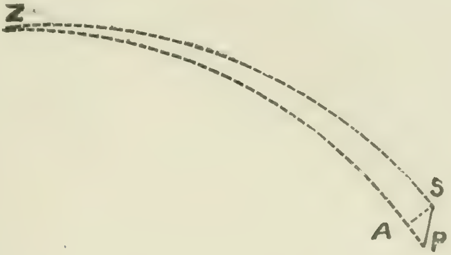
I find that 15 minutes from the time of the elongation, there is a variation of azimuth of only 22″—say one-third of a minute.

Here an error of 5 minutes in time would octiate the result only about one-tenth of a minute.

I think I have sufficiently proved that we may use calculated azimuths up to 1 hour from elongation, at least.

Before closing this matter of calculcation let me suggest another mode as a check on our work.

Let $P = 5$ hours or $75°$, and let fall the perpendicular SA.—



Find PA

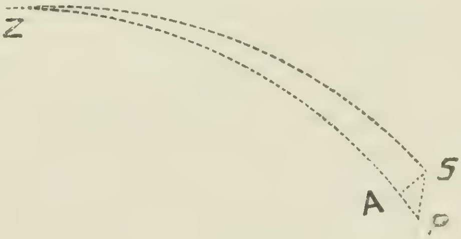
$\cot\ p\,s = 1°\ 15'\ 28'' = 11.6584.78$
$:$ rad 10
$::\ \cos\ p = 75°\quad 9.412996$

$:\ \tan\ p\,a = 0°\ 19'\ 32.4'' = 7.754518$

Find AS

radius $= 10$
$:$ sine $p = 75° = 98.34144$
$::$ sine $s\,p = 1°\ 15'\ 28'' = 437$

$:$ sine $s\,a = 1°\ 12'\ 53.6'' = 8.326381$



To find ZA—

$ZP = 46°\ 20'\ 20''$
$-\ PA = 0°\ 19'\ 32''$

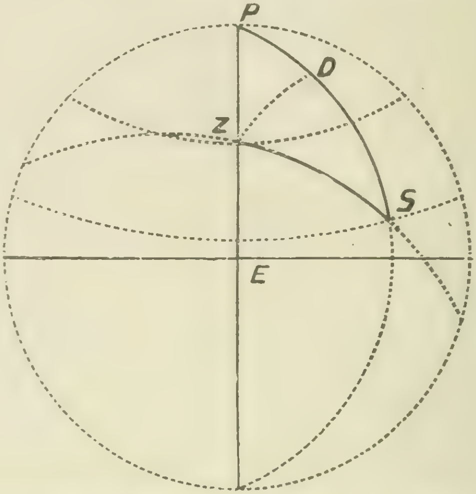
$= ZA = 46°\ 0'\ 47.6''$

To find Z the Azimuth :—

log tan $a\,s\quad 1°\ 12'\ 53.6'' = 8.326475$
radius 10
sine $z\,a = 46°\ 0'\ 47.6'' = 9.857033$

cotan $z = 1°\ 41'\ 18''\quad 11.530558$

This is as easily done as the first method of computation, and is, as I said, a check on our work.



In observations of the sun for azimuth, we have as the result of knowing our latitude, and the declination (corrected for time of observation,) and the altitude by the observation—

the co latitude *ZP*
" co altitude *ZS*
" co declination *PS*

P being the pole, *S* the sun, *Z* the zenith of observer, *E* the equator, *EZP* being regarded as the meridian of the observer.

We have in fact the spherical triangle *PSZ*, in which all the sides are given, from which we find the angle *PZS*, which is the azimuth from the north.

Here again we may let fall the perpendicular *ZD*—find the segments *SD*, *DP*, with right angles at *D*—from which to find the angles *PZD* and *DZS*, as by Napier's rule of the circular parts.

But to return to the Transit:

Keep it clean, box it when not in use, oil frequently, but leave no surplus of oil. Have oil-silk cap with draw-string for it, to use on wet and dusty days; leave all clamps loose when carrying.

Caution assistants against setting the transit down roughly. I once had an assistant that let the tripod down on a rock heavily, after the manner of a drill. The rock was solid rock road-bed, and the man was tired. Now had I hit the tripod a smart blow on end with an axe, the man would have expected injurious results. It was not easy to convince him that he had subjected the instrument to the same sort of blow.

You take an engineer or surveyor a month out on the prairie where he can only travel 100 miles a week, and be 500 miles from anywhere, give him a watch telescope that he can easily attach to the lower plate of his transit, so that he can be sure of accuracy in his angles, no matter how shaky his tripod has become, do this and note his delight.

The writer once had to anchor a syrup keg firmly on posts, and with his transit secured on that, take an angle that had to be taken.

Instrument makers do not like watch telescopes, they refuse to put them on—pity they do not spend a summer on the prairie with a transit, it might be instructive to them. The last man I asked for a watch telescope, looked at me as Mr. Littimer looked at David Copperfield; he looked as if he thought I was very young. He had no use for watch telescopes.

While making a pet of your transit, do not discard the compass.

You have to traverse the margin of a river or lake, amongst willows and water, where the general trend only counts—use the compass—tying on concession, section or lot lines as you can.

Exploring—traversing small lakes for area only—use the compass; it is rough and ready. Save your transit for its truer and better work.

Avoid perforated axis and lamp. A lantern held near the object-glass is better.

In the matter of taking angles, avoid the too common practice of taking a back sight, revolving the telescope forwards, and then taking the angle, as you incorporate thereby any error of adjustment.

Keep it in perfect adjustment, be satisfied with nothing less.

In producing lines forward, I will not repeat instructions that have been printed about setting two points on same hub, with the instrument reversed, and taking the middle point—I will merely ask you to read it again. But I will say that it is well if the ground will admit of it to set two points a head—one say at one-fourth mile and one at one-half mile, and after setting both again try if they are in line, then on going to the last point so produced, try the line backwards as far as you can see it. If you have long tangents, use targets at convenient points; you can make them by using 2 pieces of black silicia 6″ square, pinned on a piece of cotton 12″ square—the whole tacked to twigs and nailed to a picket to be left on the line.

Such targets can be carried in the pocket, cloth-pins and tacks.

When you traverse entirely around a piece of land, use latitude and departure not only for area, but to prove correctness of the work; or you may prove angles only by the rule that the sum of the interior angles of any rectilined figure is equal to twice as many right angles as the figure has sides, less four right angles.

Note the magnetic bearing of every line you sight on. It is a check and a very useful one on your reading and noting of the angles.

Keep full field notes on the spot, leave nothing to the memory or to be written down after getting back to the office. When the instrument is not in use, it is well to allow the needle to balance freely on the pin, but raise and secure it before carrying.

If in slipping or falling, you have to take a quick option between hurting yourself or damaging the instrument, I will not say you should hurt yourself, but you should save the instrument.

I have said that light instruments are best for general use. Aluminum on account of its lightness appears to be an excellent material for transits, though on account of its softness it has to be reinforced, and in some places replaced by brass.

I know of but one such instrument, it is owned by Mr. Abrey, of Toronto; it is a very fine instrument, but too expensive for general use.

A word as to impromptu repairs. It is never to be forgotten that repairs of many sorts are likely to be required when you are far from civilization : when to go home and return would mean to lose the season or be equivalent to ruin. Be prepared as best you can for such emergencies. Have with you more than one adjusting pin, large and small screw-driver, very small ones for the smallest screws, pliers, fine files, gum, spiders webs, copper wire, brass screws etc., oil, chamois, soft cotton, etc. Have with you a white silk handkerchief or white silk thread. In case you have no spiders line, dissect carefully with a fine needle a thread of the silk. It is often a good substitute. If gum fails, remove some from off the closing-flap of an envelope, place it on the ring, wash and dry the fingers, apply the line, stretching it straight, but taking care not to break it ; hold thumbs on long enough to let it fasten, remove thumbs with a twisting motion to avoid detaching the line. Remember you can get the best of oil from the badger or coon or bear, any of which you may get while on your work. Have extra bubble-tubes along, in case you get a tube slightly cracked, cover the crack with white paint. If the liquid evaporates till the bubble gets too long to do its work, take a small needle, and by gentle tapping, drill a hole on top near each end of the tube. Make a cup of putty or white lead about each hole, pour in alcohol or water till the bubble is short enough, then put white lead on the holes, saturate a thread in white lead and wind a portion of the tube about each hole. A tube so repaired will last till you get ready to go to the repairer.

Use your transit yourself, never lend it. As a horse that is lent is spoiled for your driving, so is your transit after lending spoiled for your own use.

Have I said too much about the transit. Ask not the maker or the repairer, nor the mere tenderfoot theoretical engineer, no matter how high his attainments. Rather inquire of the hard-working surveyor, one who has worked for months together in the wilds, who had to meet emergencies as they occurred, one who has made his mistakes and paid dearly for them ; he may tell you that if somebody had discoursed to him as fully as I have in this paper, he would have been saved many vexatious and costly mistakes.

DISCUSSION.

Mr. Abrey—Perhaps there are a few good points in the paper in reference to any person caught out some place where he is obliged to make the best of the circumstances, but otherwise I should not like to take the advice generally in reference to the transit. I don't like to criticise the instrument very much—perhaps I have done too much of that sort of thing heretofore, so I would like to hear some of the others. In reference to the aluminium transit, I might say that I think aluminium is good and will answer all purposes. The instrument is very light and it is strong, but it is very soft. The expense, of course, at the present time is a mere nothing compared to what it was at the time I got mine; at that time it was very expensive, but now the cost of it should be very little more than the ordinary brass instrument, so I think it is the coming metal for that purpose. I don't like to go into a general criticism of the paper without having seen it, but as to the method ot taking observations, of course we don't all do that; we take very much more refined observations than he speaks of there. Probably the paper was only intended for rough general work; I think we may assume that that was the case.

Mr. Niven—I don't profess to be an authority on instruments such as some of our surveyors, but I think there are many valuable hints in that paper to a man caught out in the woods, where he sometimes finds his instrument gets out of order. On the whole, I think that the intention of Mr. Carroll in sending his paper was good, and he has evidently given us a great amount of his experience.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

DRAINAGE DIFFICULTIES IN THE SOUTH-WESTERN MUNICIPALITIES OF ONTARIO.

By HENRY WINTER,
O.L.S., C.E., Thornyhurst.

1. The writer having learned from your Secretary, that the Association, at the next annual meeting thereof, contemplated taking into consideration the drainage question, with a view of suggesting amendments to the Drainage Laws at present in force in this province, has much pleasure in availing himself of the privilege of submitting for the consideration of the Association, a statement of a few of the difficulties that have come under his observation in connection with this question, during his residence in a part of the country in which extensive drains have been constructed and others are yet required ; believing that the nature of the training required by members of the Association in order to enable them to become members of the profession, renders the Association competent to deal intelligently with this difficult question.

A number of the large drains in this section of the country were constructed by the Government, under the Act 36 Vic., C. 38, Sec. 6 , and by township municipalities, under 36 Vic., C. 48, Sec. 451, which Acts required that the drains should be extended only far enough to obtain sufficient fall to carry the water beyond the limits of the locality to be drained, without any regard whatever to the effect produced upon lands in the vicinity of the terminus of the drain ; and the drains constructed under the above Acts, almost invariably carried the water from the lands in one locality and flooded those in another, actually causing about as much damage to the latter as benefit to the former, and resulting in a great deal of trouble, litigation, and unnecessary expense.

2. The Amended Acts require drains to be extended to sufficient outlets ; but as the party proceeding with the work is the judge of the sufficiency of the outlet, and those liable to sustain damage have no voice in the matter, the amendment has been productive of little benefit ; and very few of the drains in this section of the country have been skilfully constructed, or extended to sufficient outlets, or so constructed as to benefit one locality without injuring another.

3. In proceeding with the construction of drains in which two or more municipalities are interested, the drainage laws now in force contain no adequate provision for restraining the municipality in

which the work is instituted from locating a drain and proceeding with the construction thereof in such a manner as will prejudicially affect the lands in another municipality.

4. In proceeding with the repairs of drains heretofore constructed, the same difficulties arise as in the original construction thereof; that is, the repairs, in many instances, are proceeded with in such a manner that the attempt to remedy one evil creates another.

It therefore appears to the writer, that while the drainage laws at present in force in this province, contain ample provision for equitably apportioning the costs of drainage works, and for the adjustment of claims for damages that may arise during the progress, or in consequence of the construction of such works, they contain no adequate provision for restraining those undertaking the same from proceeding with the construction thereof in such an improper and unskilful manner as to cause serious damage to those who have no right to interfere until the damages have been actually sustained, and then only by means of tedious and expensive litigation.

The difficulties that have arisen under the Amended Drainage Laws, have resulted in an attempt on the part of a number of township municipalities to divert the water from the natural water-courses or outlets, by means of cut-off drains on the limits between the localities benefited and those damaged by the construction of the original drains, under the Acts above quoted.

5. These cut-off drains have, almost invariably, failed to accomplish the purposes for which they were constructed, and have neither been successful as cut-off drains on the one hand, nor outlet drains on the other.

6. So that the drainage difficulties have passed through three stages, or rather have passed through two stages, and are now in the third stage of progress, viz:

1st The drains constructed under the Acts above quoted, without sufficient outlets.

2nd. The attempt and failure to extend those drains to sufficient natural outlets.

3rd. The attempt, by the construction of cut-off drains, to avoid the expense of improving natural outlets or water-courses.

ADDITIONAL REMARKS BY MR. WINTER.

We have difficulties in the west with regard to drainage matters that I don't think you realize in this part of the country. I do not need to give any lengthy explanation to shew that difficulties do exist, because you can assume that from the fact that the Ontario Government found it necessary to appoint a commission to enquire into those difficulties.

(With diagram on blackboard.)

The law under the first drainage Acts required the drains to be constructed just far enough to drain the locality which was intended to be drained, without any regard to the effect these drains would have in another locality. They were constructed in accordance with the literal wording of the law. They were constructed without running them to any natural or sufficient outlet. The natural consequence was that one part of the country was drained and the other part was flooded. Probably, when I stated that they did as much damage to one part as benefit to another, I hardly stated it correctly, because the area of the locality flooded did not equal the area drained, although the damages were so great as to render it perfectly useless for any purpose until the drains were farther extended. It would be naturally supposed by those who have not had any experience in the matter, or who have not personally observed the difficulties to be faced, that there would be no trouble in making arrangements to extend those drains to proper outlets, but in reality the municipalities met with a great deal of difficulty in this way ; one section was drained and one section was flooded by the very drains that were drying the other section. And when the municipalities wished to extend those drains it had to be done by special rate upon the lands to be benefited. Well, the owners of the land up here say : We have our lands drained, we have all the relief we want : but these men down here were flooded by the water off those lands, and they urged the extending of those drains to sufficient outlets, which they had a perfect right to do. But the difficulty was, How were they going to compel the owners up here to assist ? However, after a good deal of litigation and trouble, there was an attempt made to extend those drains to sufficient outlets, but the difficulty met with there was in apportioning the expense. They did extend a number of them until they came to natural water-courses that were sufficient to carry off the water before, but were entirely inadequate to carry off the water poured down by the drains above. The end of the story was that they were never extended far enough to reach sufficient outlets. The water-courses in that section of the country are quite different from what they are here. There they are only a few inches below the general surface of the country, so if water is poured in in greater quantities than the natural outflow it does a great deal of damage.

The muncipality, or the party constructing the drain, can locate and construct the drain just as they see fit, and any party who is liable to suffer in consequence of the construction of that drain has no voice to restrain them from constructing it in such a way as to produce that damage until the damage is actually sustained. That is the way I understand the Act, and that is the way I understand it to work.

It is the same in regard to a municipality. One municipality undertakes to construct a drain, and the adjoining municipality may be perfectly satisfied that the construction of that drain will damage lands within their boundaries, but they have no power to restrain the other municipality from proceeding with the drain. They have no power to act in the matter except to pay their share of the expense, until the damage is actually done, and then they must seek redress by litigation. This has caused a great deal of difficulty between municipalities there.

In order to avoid the difficulty in apportioning the expense of extending the drains a number of the municipalities, instead of going on to improve these natural water-courses, as should have been done, undertook to make cut-off drains, to cut off the drains from the natural water-courses and run them east and west different from the natural flow of the water.

They have attempted to run drains east and west where there is no fall whatever except what they actually make artificially by the construction of the drain ; and in time of a freshet or flood the water pours down and fills up these drains and frequently gets over and damages the land down below. And besides that, in the construction of these drains, they throw up a dam that actually keeps the water back on the land that was dried by the original construction of the drains.

We are in the midst of the third difficulty now. The whole question now amounts to this : What amendment do the drainage laws require in order that that third difficulty can be got rid of? I am satisfied from my own experience that there is only one way of dealing with that third difficulty, because these cut-off drains, where there is no fall at all, will always be a failure ; they never can be constructed in such a way as to be a success. So that there will have to be some amendment to the drainage laws that will enable our municipalities to extend those drains and improve the natural outlets in order to make the drains successful, and specially rate all the parties that ought to pay for the work. I am anxious that this matter should be discussed and some opinion expressed as to what ought to be done, for this reason, that I have been in conversation with some of our legislators from the western part of the country and I am told that in taking up the question of the amendment of the drainage laws at the next session some members of this Association will be called before the Legislature and consulted in regard to this matter. The probability is that it will be some of those members who are not quite so far off as we are up in our end of the province, so that if I can manage to make the members here thoroughly conversant with our difficulties, then I have accomplished all that I have set out to accomplish. I speak particularly on this point, because in talking with our legislators in that section I have been informed that they have had some members of our Association up before them when dealing with this question, and that they did not seem to know anything more about the matter than the legislators themselves. Now, I have no doubt that there is a great deal of truth in that ; but I asked them whether they were able to explain to these professional men whom they called before them the cause of the failure in their drainage schemes and the nature of the difficulties under which we were laboring. Well, they said, they did not know that they were able to give those explanations or make it very clear. Now, there is the point ; they were never able to convey to you people here, whom they did call before them, the nature and cause of the difficulties, and therefore they could not get an intelligent opinion from you.

BIOGRAPHICAL SKETCH OF THOMAS RIDOUT,

Surveyor General of Upper Canada in 1810.

Thomas Ridout settled with his family in York, now Toronto, in 1797, and was therefore identified with the place from its earliest years. He was an Englishman by birth, from Sherbourne, Dorsetshire, where his forefathers had lived peaceful and uneventful lives. An elder brother of his had emigrated to Maryland in the old colonial days, had acquired a large property there, and also held an important position in the Government of that State. To this brother, Thomas, then twenty years of age, was sent in the year 1774. Of perils by land and perils by sea, during the stormy days of the Revolution, the young man had his full share, and a quaint account of his many adventures is still preserved in his own handwriting.

The obnoxious "tea duty" was still unrepealed, and in Boston and other colonial ports, scenes of riot and violence occurred whenever a tea cargo arrived. Mr. Ridout's first danger on landing arose from the "tea duty," and is told in his diary in the following language:—

"I took leave of my parents for the last time and embarked in the Downs, the 4th September, 1774, for New York, where I arrived after seven weeks' passage. In this vessel went also, as passenger, the merchant who had shipped, a few weeks before, some tea to Annapolis, in Maryland, against the express rules of the Convention, then sitting in Annapolis. His anxiety on his arrival was, I perceived, very great, but two days passing away, and hearing no news of his tea, he flattered himself that all things were well. The arrival of the post, however, undeceived him. He learned that his tea and vessel had been burnt by an enraged populace, and that in consequence of it his life was in danger. In an hour's time New York was in quest of him. He escaped, but I was in danger of feeling the effects of his indiscretion, to say no worse of it; for having, since our arrival, been always in his company, and lodging together, I was by many looked on as an accomplice, and, as such, was forbidden entrance to the house where I lodged. A gentleman, Hugh Wallace, who was a member of the King's Council, and an acquaintance of my brother, hearing of my arrival, protected me, and by his attentions I was secured from insult."

His Maryland brother provided him with capital to engage in trade with the West Indies and France; sugar, tobacco and wine were his merchandise, and Sindbad the Sailor's adventures were scarcely more exciting; for on the high seas between the years 1775 and 1785, each trading vessel had to run the gauntlet of privateers bent on capturing prizes, and many a time an exciting chase helped to break the monotony of a sea voyage. In the year 1787, he set off from his brother's house in Annapolis, Maryland, on a journey to the western settlements of Kentucky. On the way, however, he and his party were taken prisoners by a party of Shawanese Indians on the Ohio, and most of his companions were slain. His life was spared, either on account of an extraordinary liking with which he inspired one of his savage captors, who thenceforward became his protector, or because he was the bearer of letters of introduction from General Washington to General Scott, from Colonel Lee to General St. Clair, and to other well-known men in the western settlement. These letters, which were examined by the Indian interpreters, may have caused the Indians to expect a ransom.

It may not be inopportune here to give a few details regarding his capture by and experience amongst the Indians, during his captivity, as written by himself :—

"I set out myself on horseback and alone from Hancock, a town in Maryland, on the River Potomac, about five miles from the warm springs in Virginia, on the first day of January, 1788. The snow at this time was about three feet deep, and the weather clear and very cold. To Old-Town on the Potomac is about thirty-six miles, and from thence to the entrance of the Alleghany Mountains about thirty miles, the same road that General Braddock cut through the mountains to enable him to pass on to Fort Pitt, and near which latter place he met with so great a defeat. After dangerous travelling by a road which lay through dismal vales and led over frightful precipices, having crossed the Monongahela River on the ice, I arrived in Fort Pitt on the fourth day. There I lodged at a house of a Mr. Ormsby, where I found my friend Mr. Purviance, who had arrived a few days before. I received many civilities from the inhabitants of this place, who form a very agreeable society among themselves. Here I remained till the 12th of March following, when I embarked in one of the boats built at Red Stone for the conveyance of passengers, etc., to the falls of Ohio : two days before the ice of the river broke up with a tremendous noise, and the waters rose in the space of three days twenty feet perpendicular. Mr. Purviance and myself, with one John Black—his servant—together with our horses and baggage, embarked at Fort Pitt. Many other boats were preparing to set out on the same route; although the ice was yet floating in large masses, we committed ourselves to the furious current. At a town called Wheeling, about 100 miles down the river, we were to take in the other passengers and their baggage. The second day, in the afternoon, we stopped at Wheeling, and immediately took on board those who were waiting for our arrival. We were in all about twenty persons and sixteen horses. The boat was exceedingly deeply laden. A boat, laden as we were, put off with us for Kentucky. The next day it rained throughout, and just at the close of the evening we reached the first settlement of Kentucky, called Limestone. Here we went on shore, and almost all of the party left us the next morning, taking their route by land to their respective homes. The other boat, whose company was also reduced to five or six persons, set out for the falls early that morning. We followed in the afternoon. The distance from the falls to this place was 170 miles. The weather was remarkably pleasant, and the moon being now full and the nights serene and clear, added greatly to the agreeableness of our voyage. The spring, too, began to show itself, and the trees, especially those on the river, were already in leaf. Not often had I felt so much satisfaction or delight of heart as I did on the second morning, which was Good Friday.

"Our tranquillity, however, was soon to give place to the greatest anxiety and alarm, for on turning a point which opened to our view a considerable extent of the river, we saw, at some distance on the Indian or west side of it, a boat like our own amongst the bushes, which appeared to be the same which had left Limestone a few hours before we did. Whilst we were conjecturing the cause of such apparent delay, we perceived several people running about the shore, and a boat to put off full of people, whom we soon, to our surprise and terror, discovered to be Indians, almost naked, painted and ornamanted as when at war.

" They soon came up with us, and about twenty leaped into our boat like so many furies, yelling and screaming horribly, brandishing their knives and tomahawks, struggling with each other for a prisoner. A young man, painted black, first seized me by the arm, when another, an elderly man, who seemed to be a chief, took me from him ; this Indian was of a mild countenance, and he gave me immediately to understand I should not be hurt, holding me by the hand to show his property in me.

"As we neither did nor could attempt any resistance, none of us at this time suffered any injury in our persons, but they began immediately to strip us ; my companions were soon left almost without covering. Several attempts were made to strip me of my clothes, which were opposed by the Indian who held my hand. At length he acquiesced in the demands of one who began to be violent, and I lost my hat, coat and waistcoat. By this time we had gained the bank of the river, and were then led to a great fire, around which sat the war-chief, Nenessica, and about sixty Indians ; their whole party was ninety. To the chief I was presented by his brother, the man who had held my hand. After examining me some time with attention, and conversing with those around him, who eyed me with no less complacency, the chief gave mehis hand, and presented his pipe to me. He then made signs for me to sit down by him, which I did, when several chiefs introduced themselves and shook hands with me in particular a Pottawatamie, exceedingly well dressed after their manner, and who was one of the finest figures I had ever beheld ; he appeared to be about twenty-seven years of age, and to be upwards of six feet in height. No other prisoner received the civilities which I did. Whilst I was sitting by the chief I heard myself called by name, and looking around saw two young men tied and sitting at the foot of a tree ; they had been taken early in the morning out of the boat which had sailed before us. They said a lock of hair had been taken from each of their heads, and that they had been tied several hours in the manner they now were, and apprehended they were doomed to be put to death, and as I seemed to be taken into favor, they begged I would intercede for them. Upon my requesting this favor the Indians released them.

"The prisoners were ordered to seat themselves in a row fronting to the west on the ground, having the woods immediately in their rear. On my left were two of my companions, next to me on my right was my friend Mr. Purviance, and next to him the other six: opposite to us, on the south-east, was the river. As soon as we were seated Mr. Purviance began to discourse with me of our present situation, and said that as hitherto we had not received any personal ill-treatment, he hoped we were not in any great danger; it was evident, however, that some change was to take place in our situations; we remained not long in suspense. A sturdy thick-set Indian, painted black, of a very fierce countenance, with a drawn hanger in his right hand, came towards us, and addressing himself to the outermost man on the left hand, who happened to be the second from me, with a flourish of his weapon made him get up, giving him a kick drove him into the woods to the left of us.

"We all remained silent, everyone judging that his last moment of life approached. In a few minutes this savage returned and drove before him the man who had been sitting next to me on the left. Mr. Purviance then said to me, 'I believe, my friend, that we draw near our end.' These were my own sentiments also. I waited the return of the Indian for myself as his next victim; words cannot express what my feelings then were, and when I saw him approach. He came and stood before me, and, after a moment's pause, beckoned me to rise and follow him, and turned round into the woods which were behind us. I saw my friend no more. I understood some time after that he was not killed on the spot, but was taken into the interior of the country and there beat to death.

"I followed the Indian step by step, expecting every moment that he would turn upon me and put me to death. After walking 300 or 400 yards, I perceived the smoke of a fire, and presently several Indians about it; my alarm was not diminished, but as we came nearer, a white man, about twenty-two years of age, who had been taken prisoner when a lad and had been adopted, and was now a chief among the Shawanese, stood up and said to me in English, 'Don't be afraid, sir, you are in no danger, but are given to a good man, a chief of the Shawanese, who will not hurt you; but after some time, will take you to Detroit, where you may ransom yourself. Come and take your breakfast.' What a transition! passing from immediate danger and apparent certain death to a renovated life! I saw no more of my savage guide, but joined the party seated around the fire taking their breakfast, of which I partook, which consisted of chocolate and some flour cakes baked in the ashes, being part of the plunder they had taken from us. Whilst I breakfasted, an Indian, painted red and almost naked, had seated himself opposite to me and eyed me with fierceness of countenance inexpressible; his eyes glowed like fire, and the arteries of his neck were swollen and nearly bursting with rage; he said something to me in a tone of voice corresponding with his appearance, which was interpreted to me by the white man in the following words: 'He says that you are his prisoner, and that it is more easy for him to put you to death than to tell you so.' I answered calmly (for the extreme danger of the situation from which I had just escaped had prepared me for every event) that I acknowledged myself to be in his power, and that he could do with me as he pleased. This reply being made known to him his rage seemed to subside, and he said no more to me.

"The white man now informed me that in an hour or two we should begin our march, together with the other Indians and prisoners, to the village, which was about five days' journey from that place.

"About noon we began our journey into the wood, in company with about ninety Indians. The weather was dark, gloomy and cold. We passed over a rapid river on the body of a tree, which had fallen over it at a considerable height from the water. In passing my head became giddy, and I apprehended I should fall, but recollecting the yet greater dangers that beset me, I recovered a firmer step. About five in the afternoon, we came to a valley through which ran a rivulet, the land rising gently to the westward, full of large timber, but without underwood. At this place, I understood, the Indians intended to pass the night in feasting and drinking a part of the spirituous liquors they had taken from us. As the Indians intended to regale themselves and drink to intoxication, a party of Cherokees, to the number of twelve, who had deserted from their own nation to reside amongst the Shawanese, were appointed to take charge of the prisoners during the feast, of which they, the Cherokees, were not to partake, but were to keep themselves sober. We were, therefore, committed to these Indians, who withdrew to a small eminence, a few hundred yards distance from the main body.

"When they had kindled a fire they threw a few half-worn undressed deer-skins on the ground, for us to lie upon, on the west side of the fire, and then began to secure us from making an escape. They began with me, by passing a cord round the body, then between my legs, and under that part of the cord that surrounded the body, and forcing a stake six or seven feet into the ground, they fastened the cord to it, and on the top of the stake they fixed a small bell, so that I could not stir without its ringing. Lest I should make use of my hands, they put my fists into a small leather bag which they had tied round the wrist; then they drew the string round the wrists so tight that I was instantly in an agony of pain. It was to no purpose to complain. I could not prevail upon them to slacken it, but ordering me to lie down, they threw over me a small, old blanket. My place was the outermost of the row, next to the drunken Indians, exposed to the weather, which was very cold and tempestuous. There fell much sleet, but the agony I suffered in my wrists, hands and arms made me insensible almost to everything else.

"About midnight, I was roused by the screams and whoops of an Indian from the other encampment, who seemed coming towards us. His yells and shouts became more and more loud and terrific; and turning my eyes towards the valley, I perceived, by the glimmering lights of the fires and of the moon, an Indian staggering with drunkenness, brandishing a knife in one hand and a tomahawk in the other, making all the haste he could towards us, and shrieking most horribly as he approached where I lay. I have no doubt but that he was bent upon murdering the prisoners, and that I should be his first victim. He had already come within one step of me, and his hand was lifted to give me the fatal blow, when one of Cherokees sprang from the ground and caught him round the waist, and after some struggling mastered him and obliged him to retreat, which he did muttering.

"As my sufferings were extreme from the strictures round my wrists, I entreated the Cherokee to loosen them, but giving me a look of savage fierceness, he laid himself down again unconcerned at the tortures I endured. In the space of about an hour the drunken Indian made a second attempt to execute his purpose; but as he approached yelling and shouting, two Cherokees laid hold of him as soon as he came near the fire, and tying him neck and heels together, left him wallowing in the snow for the remainder of the night. At length the long-wished-for morning came, and my hands were set at liberty; but they were so swollen and black with the stoppage of circulation, that some hours elapsed before I could bend my fingers or use them. Soon after the sun had risen, the Indian chief to whom I had been given made his appearance. He seemed about fifty years of age, was a tall, slender man, and of a very pleasing and animated countenance. He, smiling, took me by the hand, called me 'Nacanah,' or his friend, and seeing my attention fixed on a wound, over one of his eyes, he, pointing to it, said, 'Ah! matowesa whiskey,' meaning he had got drunk with wicked whiskey or spirits, and that the wound was the bad consequence of it.

"When the evening of our day's journey drew nigh, I dreaded lest I should be treated as I had been the preceding night; but when we lay down, which was before a good fire, my friend covered me with a blanket, and only fastened me round the body with a rope, which he drew under himself and lay upon. He never afterwards used this precaution, leaving me at perfect liberty, and frequently during the nights that were frosty and cold, I found his hand over me to examine whether or not I was covered. I think it was towards the third evening of our march that we came to the banks of the great Miami, a very rocky and rapid river, which empies itself into the Ohio, and whose waters were very high. My friend, another Indian, and myself begun to make a small raft to pass over this rapid stream, which was about 300 feet wide. I went awkwardly about my work. The Indian smiled, and allowed me to desist from working, They soon prepared a small raft, and we all three placed ourselves upon it, and with the help of a pole by way of paddle, we soon gained the opposite shore, having been carried a short distance down the stream. Soon after we encamped on the left bank of a small river, having a steep hill covered with woods on the left side. A good fire was kindled, and we supped heartily on some roasted venison, part of our day's sport—for these woods were full of the finest deer, buffalo and wild turkeys.

"When the next morning came, I found myself so extremely weak and bruised, that upon making it known to my friend, he took my burden upon his shoulders, in addition to his own, without making the least reproach. I was, however, so much exhausted, that I was but little relieved by this kind action, yet I advanced as well as I could till about ten o'clock.

"My friend was then at some distance before us, not out of sight, and the great war chief immediately following me. I found my strength entirely gone, and turning round to the chief, made a sign that I wished to sit down. He pushed me on very angrily. I found I could not proceed, and turning again, made another attempt to obtain his consent to sitting down. With great anger he again pushed me on, and made a stroke at me with his tomahawk, which I avoided by exerting all my strength, and springing forward.

"At this critical moment I recollected that when they took my coat from me, I secured my pocket-handkerchief and half a guinea, which I put in a knot in one corner of it, and tied it around my waist, where it now was. With some difficulty and much agitation I loosened the knot, took the half guinea, and turning round, held it up between my finger and thumb. The savage smiled and beckoned me to seat myself on the ground, on which I fell and immediately fainted.

"When I recovered, I found the great war-chief and my friend both sitting by me. They spoke kindly to me, and gave me to understand by pointing to where the sun would be at two o'clock, that I should then arrive at the village. Immediately on entering the village we were conducted to the council-house, at the door whereof we were obliged to sing and shake the rattles for half-an-hour, and then entered the house (without suffering any ill-treatment), in the centre of which was a fire, and over it hung a kettle with venison and Indian corn boiling.

"On arriving at his hut, my master presented me to his wife. She appeared to be forty years old and rather corpulent. Her looks were extemely savage, and she eyed me with contempt ; the chief, on the contrary, was of the most mild and intelligent countenance. I shall in this place declare that during the whole of the time I was with the Indians, I never once witnessed an indecent or improper action amongst any of the Indians whether young or old.

"At the end of three weeks from my capture, the whole village having collected their horses and peltry, began their journey towards the Wabash and Detroit. I travelled, at my ease, on foot, carrying an unbent bow in my hand. We seldom travelled more than fifteen or twenty miles a day, setting out after breakfast, about an hour after sunrise, and encamping about the same time before sunset, and if we came to good hunting ground, reposed ourselves for the day.

"My dress consisted of a calico shirt, made by an Indian woman, without a collar, which reached below the waist ; a blanket over my shoulders, tied around the waist with the bark of a tree ; a pair of good buckskin leggings, which covered almost the thighs, given me by the great war-chief ; a pair of moccasins, in which I had pieces of blue cloth to make my step easier ; a breech-cloth between my legs ; a girdle around my waist ; and a small round hat, in which the Indian placed a black ostrich feather by way of ornament (the smaller the hat the more fashionable.)

"We at length drew nigh to a village, where I was informed a great council was to be held concerning me, and for the examination of my papers and letters. We encamped within five or six miles of it, and the next day my friend the chief, accompanied by half-a-dozen more Indians and myself, all mounted on horseback, rode to the village where the council was to be held. On our way thither we put up a flock of wild turkeys. Having no fire-arms, we hunted them down, and having caught a very large one, weighing about twenty-five pounds, it was tied, alive, to my back as I rode, and thus we galloped to the village.

"Upon our arrival, several chiefs, to the number of fifty or upwards, opened the council. My papers were read by an interpreter, a white man, who several years before had been taken prisoner. After much sober discussion, in which it was declared that I was an Englishman and not an American, they broke up, after allowing my master to take me to Detroit, and there to receive my ransom.

"We continued to pursue our route by easy journeys. I remarked that our numbers daily diminished, but was told the reason was that provisions began to be scarce, the woods not affording the usual quantities of wild animals. The small party I was with bore a share of this scarcity. We had killed two wild cats, and though not esteemed by the Indians as good food, they were very acceptable at this time. At length our family, consisting of the chief, his wife, myself and negro, travelled alone. In the usual manner we encamped early in the evening, and set forth again in the morning after breakfast.

"One delightful morning, as the sun rose, my friend walked a few paces from his tent (for occasionally he made use of a Russia sheeting one), and seemed to address himself to that glorious orb in a manner, style of words and accent that I had not witnessed before. His manner was dignified and impressive.

"Having arrived within half-a-mile from the village, situated on the White river, which empies itself, six or seven miles down, into the Wabash, he directed us to stop, and went himself to the village to prepare for me, as I afterwards learnt, a good reception. At the place we stopped there were two poles, fifteen or twenty feet high, standing upright, the bark stripped off, the one painted red and the other black. They were called war-poles, and indicated that prisoners had been brought to that village.

"About sunset of the same day we arrived I heard the Indian war-whoop on the other side of the river, at the village through which we had passed. Immediately my friend, his wife, and the negro, left the hut and went to the opposite side of the river, and I was soon left alone in the camp. During that night I did not see anyone moving, but about two hours after sunrise the next morning I perceived several Indians assembled at the door of a house near the water's side, opposite to where I was, and soon after I saw a young man run out of the house naked, his ears having been cut off, and his face painted black: the Indians following with the war whoop and sang, driving him before them, through a valley. They then ascended a hill, a little lower down the stream, distant about four or five hundred yards. As soon as they gained the summit of the hill, I heard the young man scream, and the Indians give a shout. I perceived a smoke, and judged that the fire was preparing. After a short interval I heard the poor victim utter a dreadful shriek. They were repeated without intermission for a few minutes. The Indians shouted during the interval of tortures. I heard the groans of the poor sufferer, and then his shrieks recommenced under new tortures. These tortures, with remissions, continued about three hours, when his cries ceased. The Indians then returned. To express my feelings during this scene would be impossible, and I began to think that my own fate might be similar.

"After three or four days my friend collected his horses and peltry, and with his wife and negro, set off with me for Detroit, by way of the Miami villages, where I understood was a trading port; several traders, English and French, living there. I was on horseback; we all soon entered the woods. The mosquitoes were so troublesome that we got no rest night or day, notwithstanding the smokes we made to drive them away. After, I think, four days' journey, we arrived at a branch of the Miami river, much swollen with rain. We crossed it with difficulty and encamped on a plain, where I saw several Indian huts scattered. I slept soundly that night, in the pleasing expectation that I was drawing near my deliverance.

" During this time I was informed that another council would be held upon me, in which it was to be determined whether I should be permitted to be taken to Detroit and ransomed. The day accordingly came in which the council was to be held. The Indians having assembled, I was also conducted thither. The council was under the authority of a Captain John, a Shawanese chief, before whom my case was to be decided. One Simon Girty, an Indian interpreter, now living on the Detroit river, was present. I perceived my master and friend was much dejected, and did not speak to me. Several women endeavored to cheer me by saying I should not be hurt. The council was at length opened, and the Indian who had burned the young man contended for me. He insisted that I was a spy and that I knew the whole country. Much was said, and my papers and letters were again brought forward, read, and explained. At length, after a cool and deliberate hearing, the chief pronounced my discharge, and told my friend that he might set out with me as soon as he chose. His eyes sparkled with joy when relating the result of the deliberations of the council. He would have deferred our departure till the morrow, for the Indian traders who lived on the other side of the river, which also formed a junction here with the other two, had long expected me, but dared not intercede for me whilst my life was at issue. After urging with all my power to set off immediately, my friend got a canoe and took me over to the traders' village, called Fort Miami; and both the English and French gentlemen were waiting, with open arms, to receive me, as they had been acquainted with the chief's decision in my favour. The names of the English gentlemen of this place were: Sharpe, Martin, Parkes and Ironside. Mr. Sharpe conducted me to his house, gave me a shirt, and Canadian frock and hat, trousers and shoes. I remained here three days. It was here I found my Bible, several books, a German flute, and some few other articles; but a tortoise-shell box inlaid with pearl, in which was my mother's wedding ring, and a gold coin of the Emperor Nero (weight about four pennyweights, and in great perfection), given me by a lady of Lisborne, in France, were lost to me forever. The coin had been found with many others at Saint Onge, in France. A French gentleman of the Miami lent my friend, on my account, his large canoe to carry us, with the peltry, to Detroit, distance about 250 miles by water.

"We embarked early on a Sunday morning, took in the peltry, his wife, myself and negro, and descended the Miami river, taking also two Indian women, whom we were to put on shore at an Indian village two miles down the river. We did so, and proceeded. After descending about fifteen miles, we stopped at a white man's house, who was an interpreter among the Indians. I naturally spoke of my deliverance in terms of joy, but I thought he seemed not much to encourage my hopes, for he knew the dangers which yet surrounded me, whilst I was happily ignorant of them. On our way to the mouth of the Miami river, which empties itself into Lake Erie, we passed several parties of Indians returning from Detroit. They were generally drunk, and I was in continual terror until we separated. At length we got to the falls, where there was a house belonging to a Captain McKee, Deputy Superintendent of Indian affairs, and a Mr. Elliott. They were not there, but we received kind treatment and victuals from the Indians of their respective families. Soon after leaving these houses we reached the lake, and after coasting the west end of it for about thirty-eight miles, we entered the Detroit river. A few miles up this river there was another house of Mr. Elliott's. He did not happen to be at home, but we were kindly treated. The next day we descended the River Detroit, and passed the night upon an island, where there were several Indian families.

"Early the next morning, being Sunday, we arrived at Detroit. My friend introduced and presented me to Captain McKee, who received me with civility, and with whom I breakfasted. He then accompanied me to the commanding officer, Captain Wiseman, of the 53rd regiment, and introduced me to him. By this gentleman, and by all the regiment, I was received as a brother.

"N.B.—In the year 1799 my friend Kakinathucca and three more Shawanese chiefs came to pay me a visit at my house in York. They saw me and my family with pleasure, and my wife and children contemplated, with great satisfaction, the great and good qualities of this worthy Indian. He did not return home without bearing a testimony of my gratitude. He died about five years ago, under the hospitable care of Matthew Elliott, Esq., Superintendent of Indian affairs at Amherstburg, at the entrance of the Detroit river."

After a captivity of four months, he was brought to Detroit, then an English garrison. Here the officers of the 53rd regiment received him as a brother, clothed him, filled his purse, and as the regiment was about leaving for Montreal, they invited him to accompany them thither. On the way they stopped at Fort Erie and Niagara, and at the latter place were hospitably entertained by Colonel Hunter, of the

60th, who commanded a battalion there. This officer was afterwards Lieutenant-Governor of Upper Canada and Commander-in-chief of the forces in both Canadas.

They arrived in Montreal about the middle of July, 1788, and Mr. Ridout was kindly received, as his old journal relates, by Sir John Johnson, Captain Grant, and Lord Dorchester, then Governor-General, residing at Quebec. On the 26th May, 1789, he married Mary Campbell, daughter of Alexander Campbell, a U. E. Loyalist, settled at the Bay of Quinte. Soon after he received an appointment in the Commissariat Department and removed to Newark, now Niagara.

He was next employed in the office of D. W. Smith, Surveyor-General in 1793, and from 1799 to 1807 he was employed jointly with others as Acting Surveyor-General. Afterwards, in 1810, he was finally appointed Surveyor-General of Upper Canada. At this time he resided in York, which was then a rising little town, and is now the important City of Toronto. Here he remained until his death in 1829.

He was a kind and exemplary father of a numerous family, who loved and revered him and mourned his departure, the faithful servant of Government for nearly forty years, he endeared himself to the inhabitants of Upper Canada, and so won their affections by his unremitting attentions to their interests and unwearied courtesy to themselves, that they justly considered him an ornament to the colony. To a highly cultivated mind he added the most polished manners, and, what was far better, the meekness and the humility of a Christian looking forward in faith to a blessed immortality.

OBITUARY.

We have this year to record the decease of one who was a prominent member of the Association of Provincial Land Surveyors of Ontario from the date of its inception until physical infirmity demanded his retirement from active life. Mr. Isaac Lucius Bowman died at Berlin on the 3rd of February last, after a prolonged illness.

He was born on the 23rd of May, 1830, near Freeport, at the Grand River, and was the second son of the late John B. Bowman, who came to Canada from Lancaster County, Pennsylvania, in 1816. At the age of 20 he entered upon a course at Rockwood Academy, near Guelph, where he spent two years, at the end of which time he went to Oberlin College, Ohio, and devoted four years to the study of mathematics and classics. Returning to Canada he became interested in school work, and had charge of several schools in the county of Waterloo. In 1861 he was appointed School Inspector of that county, which position he filled until about 1870. From 1867 to 1872 he was principal of the Freeport Academy.

In 1873 Mr. Bowman began the study of Land Surveying, receiving his commission as Provincial Land Surveyor in 1876, and the remainder of his career was devoted to this profession, he having been frequently in the employ of the Ontario Government. He also enjoyed other trusts of a public nature, his being a familiar face during 26 years at the sessions of the Waterloo Township Council.

A member of the United Brethern Church, he also held the position of local minister in the conference in which he resided.

Mr. Bowman left a widow and four sons. Of the latter, three, like himself, are Surveyors and Civil Engineers, and are engaged as follows: L. M. Bowman, Sanitary Engineer in the Health Department, Toronto; A. M. Bowman, Assistant Engineer at the Government improvements on the Ohio River, at Pittsburgh, and F. M. Bowman, chief Draughtsman for Messrs. Riter and Conley, at Pittsburgh, Pa. His fourth son, H. M. Bowman, is an under-graduate in Arts, in attendance at Toronto University.

OBITUARY.

Since the date of our meeting this year, one of the patriarchs of our profession has passed away. Mr. Thomas Fraser Gibbs, of Adolphustown, died on the 15th of April, in his 82nd year.

He was born in Edinburgh, Scotland, on the 6th Dec., 1811, and came with his parents to New York when about 11 years of age. Here he received a liberal education, and having special talents for mathematics and mechanical drawing, particular attention was paid to these branches, leading to his adoption of Land Surveying as his profession. Before, however, he was legally qualified to practise, Mr. Gibbs removed in 1840 to Kingston, U.C , and having in the following year passed his examination before the Surveyor General, he received his commission as a Provincial Land Surveyor from the then Governor-General, Baron Sydenham, bearing date 31st May, 1841. Since that date Mr. Gibbs has been known as one of the foremost Land Surveyors in the Province, and in 1864 he was honored with an appointment as member of the Board of Examiners for Provincial Land Surveyors, at the hands of Rt. Hon. Viscount Monk, which position he continued to hold during his lifetime. A year or two previously he had purchased and removed to the property bordering on the Bay of Quinte, which has been his home ever since.

Mr. Gibbs was a registered member of the Association of Ontario Land Surveyors, and about two months before his death addressed a letter to the Association, expressing his hearty approval of the aims and objects of that body, and regretting the fact that he was unable through physical disability to take part in the annual meeting. Arrangements were being made whereby his name would have appeared in the honorary list of those who were granted exemption under the Ontario Land Surveyors' Act, but these were terminated by the news of his death.

He was of a retiring disposition, yet genial and warm-hearted with those who had the pleasure of his intimate acquaintance. Among his earliest friends and patrons were the late Hon. John Macauley, the Venerable Archdeacon Stewart, Thomas Kirkpatrick, Sir John Macdonald, Sir Alex. Campbell and Sir Henry Smith, all of whom remained his friends through life.

In his religious views he was brought up a Presbyterian, but there being no church of that denomination convenient to his home, he gave of his means to the support of the Church of England, of which Church his family were members.

A widow, one son and two daughters are left to mourn his loss.

APPENDIX.

BY-LAWS.

Definitions in the following By-laws as defined by the "Ontario Land Surveyors' Act."

Definitions

The word	"Association"	means	The Association of Ontario Land Surveyors.
"	"Council"	"	The Council of Management.
"	"Board"	"	The Board of Examiners.
"	"Chairman"	"	The Chairman of Council.
"	"Secretary"	"	Secretary-Treasurer.

PREAMBLE.

Authority for By-laws.

The following By-laws are enacted under the powers granted by the "Ontario Land Surveyors' Act"—(Cap. 34, Ont. Stat. 1892.)

THE ASSOCIATION.

Annual Meeting of Association.

1. The Annual General Meeting of the Association shall be held (as provided by said Act) in the City of Toronto, on the fourth Tuesday in February in each year, at such place as may be selected by the Council.

Special Meetings.

2. Special meetings of the Association may be called by the President, or shall be called by him at the written request of ten or more members.

Notice to be given by Secretary.

3. Due notice of such meetings shall be given by the Secretary to each member of the Association by circular letter posted to his registered address at least 10 days before any such meeting.

Constitution of quorum.

4. Fifteen members shall form a quorum at any meeting of the Association for the transaction of business.

THE COUNCIL.

Duties of Council.

5. In addition to the duties assigned to the Council by said Act, it shall have the direction and management of all the affairs of the Association, and shall appoint the several Standing Committees and name the Chairman of each.

Regular meetings of Council.

6. There shall be three regular meetings of the Council in each year, one to be held on the first day of the annual meeting of the Association, and one during each of the meetings of the Board as prescribed by said Act.

Special meetings of Council.

7. Special meetings may be called by the President or Chairman.

Notice to be given by Secretary.

8. Due notice of every such meeting shall be given by the Secretary (as above provided) to each member of the Council.

Constitution of quorum.

9. At any meeting of the Council when business relating to the property or to the financial affairs of the Association is transacted, five members shall form a quorum; for the transaction of any other business three shall form a quorum.

Annual Report of Council.

10. The Council shall make a report of the affairs of the Association at the Annual Meeting, which report shall include the report of the Secretary and also of the Board of Examiners.

Board of Examiners to report to Council.

11. The Board of Examiners shall make a report to the Council at the meeting held in November in each year.

STANDING COMMITTEES.

Standing Committees.

12. The Standing Committees shall be as follows: each shall be composed of not less than 5 and not more than 9 members.

Committee on Land Surveying.
" Drainage.
" Engineering.
" Topographical Surveying.
" Entertainment.
" Publication.

Duty of Standing Committees.

13. Each Standing Committee appointed by the Council shall endeavour to advance the interests of the Association in that branch allotted to it.

Provision for meetings.

Meetings of any Standing Committee shall be held at the call of the Chairman, three members to form a quorum.

Standing Committees to report to Association.

Each Standing Committee shall present to the Association or to the Council an Annual Report on the work done by said Committee.

ORDER OF BUSINESS AT MEETINGS OF ASSOCIATION.

Order of business.

14. The following shall be the order of business at the meetings of the Association:—

1. Reading of minutes of previous meeting.
2. Reading of correspondence and accounts.

3. Reports and papers.
4. Unfinished business.
5. New business.
6. Nomination of officers (if at the General Annual Meeting).
7. Adjournment.

RULES.

15. All motions must be in writing, and shall contain the names of the mover and seconder, and must be read from the Chair before being discussed. Procedure.

16. Reports of Committees must be in writing and signed by the Chairman thereof. Reports of Committees.

17. No member shall speak on any subject more than once, except the introducer of the subject, who shall be entitled to reply; every member, however, shall have the right to explain himself subject to the discretion of the Chair. Rules of speech.

18. When a motion has been finally put to the meeting by the Chairman, all discussion thereon shall be closed. Discussion closed.

19. Any motion may be re-opened by a majority vote of those present. Majority vote may re-open any motion.

20. The Chairman of the meeting shall appoint two scrutineers when a ballot is taken, as defined in sec. 22 hereof. Appointment of Scrutineers.

21. Every member while speaking shall address the Chair. Speakers to address the Chair.

22. All voting at any General or Annual Meeting shall be by standing vote, unless a ballot be demanded by at least two members. Voting at General or Annual Meetings.

23. Parliamentary rules to govern in all cases not provided for in preceding sections. Parliamentary rules to govern.

DUTIES OF OFFICERS.

24. The President, or in his absence the Vice-President, shall preside at all meetings of the Association; in the absence of both, the meeting shall appoint a Chairman. Presiding officer at Association meetings.

25. The Chairman shall preside at all meetings of the Council; in his absence the meeting shall appoint a presiding officer. Presiding officer at Council meetings.

26. In addition to the duties assigned to him by said Act, the Secretary-Treasurer shall keep an accurate record of the proceedings at all meetings of both the Association and the Council in separate books, conduct all correspondence, announce all meetings, receive all fees and subscriptions and other moneys. Duties of Secretary-Treasurer.

He shall, under the direction of the Council, deposit all moneys in such bank or other financial institution as it may select. He shall pay no bills unless sanctioned by the Council and signed by the Chairman. All payments of $10.00 and upwards to be made by cheque, signed by the Secretary and countersigned by the President, or in his absence by the Chairman of the Council. He shall submit an account of all moneys received and paid by him under the said Act and these By-laws to the Council at the Annual General Meeting of the Association, and shall perform such other duties as may from time to time be assigned by the Council.

27. The Secretary-Treasurer shall give bonds in the usual form to the amount of $1,000, such bond to be in the custody of the President, and deposited in the bank where the funds of the Association are kept.

EXAMINATIONS.

The Sec-Treas. to give bonds. Where they shall be deposited.

28. Candidates for admission to apprenticeship are to be examined as follows, in the subjects prescribed in Rev. Stat. Ont., C. 152, S. 7.; and no candidate will be admitted unless he obtains at least the minimum marks set opposite each subject, and at least a total of 350.

Examination of candidates for apprenticeship

SUBJECT.	Max. Marks.	Min. Marks.
1. Penmanship	50	30
2. Orthography	50	40
3. Arithmetic (Fractions, Decimals, Square Root)	100	40
4. Logarithms, Algebra (including Equations 1st degree)	100	30
5. Euclid, (Books 1, 2, 3 and 4.)	100	40
6. Plane Trigonometry and Rules for Spherical	100	30
7. Mensuration of Superficies	50	25
8. Linear Drawing (use of ruling pen and construction of scales)	50	25

29. Candidates for admission to practice are to be examined as follows, in the subjects prescribed in Rev. Stat. Ont., C. 152, S. 10 ; and no candidate will be admitted unless he obtains at least the minimum marks set opposite each subject, and at least a total of 900.

Examination of candidates for admission to practice.

SUBJECT.	Max. Marks.	Min. Marks.
1. Geometry, including the first 6 Books of Euclid, excepting the last thirteen propositions of the 5th Book	100	50
2. Algebra (Simple and Quadratic Equations, Progressions and Exponents)	100	40
3. Trigonometry (Plane and Spherical)	100	50
4. Mensuration of Superficies and laying out and dividing land	150	75
5. Descriptions by metes and bounds	100	75

Subject.	Max. Marks.	Min. Marks.
6. Use and adjustment by instruments for surveying and levelling	100	70
7. Laying out of Curves	50	20
8. Practical Astronomy, including finding of Time, Latitude, Longitude, Azimuth Var: of compass and drawing meridian lines	150	
9. Survey Act	150	
10. Mining Act, Registry Act, Municipal Act, Ditches and Water-courses Act (so far as they relate to surveys and drainage)	100	35
11. Levelling	50	40
12. Principles of Evidence and drawing up affidavits.	80	30
13. Taking of field notes and preparing of plans	100	60
14. Geology and Mineralogy, Rudiments of	75	25

30. If a candidate for admission to practice obtains at least the total of 900 marks, but fails to obtain the minimum marks in at most two of the subjects, such candidate may at a subsequent examination be examined only in the two subjects in which he has failed.

31. The Council may make from time to time such regulations as it considers necessary for the proper carrying out of these examinations.

The Council to regulate examinations.

32. Any complaint against a member of the Association or against any unlicensed practitioner shall be filed with the Secretary, who shall immediately forward the same to the Chairman.

Complaints against members or any unlicensed practitioner to be filed with Secretary.

If the matter complained is of a serious and pressing nature, the Chairman may at his discretion call a special meeting of the Council for the purpose of hearing said complaint; if not so acted on, the complaint shall be heard at the next regular meeting of the Council.

The Chairman may call a special meeting.

In the case of a member of the Association, the Council shall take action as defined in the said Act.

Procedure where the delinquent is a member.

In the case of any unlicensed practitioner, the Council, if satisfied as to the justice of the charge, shall name a prosecutor and direct him as to his action in the conduct of the case, and shall allot such portion of the penalties, or authorize the payment of such fees as it may deem expedient.

Procedure where the delinquent is an unlicensed practitioner.

33. The Council shall have power to pass any By-law which it deems expedient for the good of the Association, and such By-law shall have the same force until the next Annual Meeting, as if it had been passed by the Association. Such By-law must be reported to the Association at the next Annual Meeting, and action taken thereon. All members of the Association shall be notified by the Secretary of the passing of such By-law by the Council.

The Council has power to pass By-laws.

RULES AND REGULATIONS

Adopted by the Board of Examiners and ratified by the Council under the authority of By-law 31.

1. The examination sittings shall commence each day at 9.30 a.m., continue until 12.30 p.m., recommence at 1.30 p.m., and continue until 4.30 p.m., day by day until completed.

2. All the papers will be collected at the close of each sitting, and candidates will not be permitted to write on any question on such papers at any future sitting.

3. Any candidate obtaining assistance, during the hours of examination, by copying the papers of another candidate, or otherwise, will at once be dismissed, and any candidate who shall permit such copying or give such assistance, will be considered equally guilty and treated similarly.

4. Each sheet of paper shall have at the top the subject and number of question and shall be signed and folded by the candidate, and endorsed with his name and the subject and number, and not more than one answer shall be written on the same sheet of paper.

5. The candidate shall not write on one line more than one step in Geometrical or Algebraic work. A single step may cover several lines, but two or more should in no instance be put on the same line. They should be written thus:

Because $A = B$
And $B = C$
Therefore $A = C$

6. No other person than the examiners, Secretary and the candidates shall be admitted into the examination room.

7. No books or diagrams of any kind, except those allowed by the Board, shall be brought into the examination room.

8. Candidates are to present themselves punctually at the hours appointed for the commencement of the examinations, and no candidates will be allowed to enter the examination room later than fifteen

minutes after that time, nor will any candidate be permitted to leave the room during a sitting, but so soon as he has finished his papers he may hand them to the examiner, after which he will not be allowed to re-enter until the next sitting.

9. A candidate rejected by the Board shall not be entitled to a new examination before the next regular meeting of the Board.

10. Each candidate for "Admission to Practice" shall bring with him an instrument suitable for taking the necessary observations required in sec. (8), By-law 29, which he shall submit to the Board for their examination and approval, and he shall also submit a plan and field notes of a survey, all made by himself, which will be filed with his papers.

11. Each candidate for admission to apprenticeship shall bring with him a ruling pen and scale.

LIST OF CANDIDATES who have passed the Preliminary Examinations for Land Surveyors in Ontario, since 1885.

NAME OF CANDIDATE.	ADDRESS.	Date of Preliminary Certificate.	TO WHOM ARTICLED.	DATE.	Term of Service	Date of Final Exam.	GENERAL REMARKS
Ludgate, Bruce Allin	Peterboro'	6th Jan., 1885	T. R. Hewson, Peterboro'	5th May, 1885	1 year	8th July, 1886	Grad. S.P.S., 1885
Ross, David Andrew	Mount Forest	9th April, 1885	Hugh Wilson, Mt. Forest	10th April, 1885	3 years	11th Apr., 1890	
Stephens, Lewis Frederick	London South	9th April, 1885	J. M. Moore, London	12th Aug., 1885	3 years	11th Apr., 1890	
Farncomb, Frederick Wm.	T'p of London	9th April, 1885	C. A. Jones, London	12th Aug., 1885	3 years	6th Nov., 1889	
Booth, George Algernon	Sydenham	9th April, 1885	C. E. S. Booth, Kingston	9th April, 1885	3 years	...	
Decker, Edwin Stanton	St. Thomas	7th July, 1885	A. W. Campbell, St. Thomas.	8th July, 1885	3 years	12th Nov., 1888	
Stewart, Walter Edgar	Aylmer, Ont.	7th July, 1885	J. A. Bell, St. Thomas	7th July, 1885	3 years	12th Apr., 1892	
Gurd, John Abrom	London West	7th July, 1885	C. F. Cox, London	30th Sept., 1885	3 years	...	
McKay, Owen	Forester's Falls.	7th July, 1885	Speight & VanNostrand, Tor.	19th Dec., 1885	1 year	7th Jan., 1887	Grad. S.P.S., 1885
Robertson, Alex. Morton	Goderich	7th July, 1885	Not articled	...	...	...	
Bowman, Herbert Joseph	Berlin	6th Oct., 1885	P. S. Gibson, Willowdale	30th Dec., 1885	1 year	7th Jan., 1887	Grad. S.P.S., 1885
Matthews, Herbert Edward.	London	6th Oct., 1885	J. M. Moore, London	6th Oct., 1885	3 years	...	
Fitzgerald, James	Peterboro'	4th Jan., 1886	J. W. Fitzgerald, Peterboro'	7th Jan., 1886	3 years	...	
DeMorest, Richard Watson.	Toronto	5th April, 1886	Speight & VanNostrand	5th April, 1886	3 years	9th Apr., 1889	
Bowman, Arthur Meyer	Berlin	6th April, 1886	I. L. Bowman, Berlin	1st June, 1886	1 year	11th Nov., 1887	Grad. S.P.S., 1886
Cameron, Alfred John	Peterboro'	7th April, 1886	T. R. Hewson, Peterboro'	15th April, 1886	3 years	9th Apr., 1889	
Laird, Robert	Toronto	6th July, 1886	P. S. Gibson, Willowdale	15th Sept., 1886	1 year	11th Nov., 1887	Grad. S.P.S., 1886
Sherman, Ruyter Stinson	Brantford	6th July, 1886	T. H. Jones, Brantford	6th July, 1886	3 years	12th Apr., 1890	
Nie, Josiah Andrew	Toronto	6th Oct., 1886	G. B. Abrey, Toronto	6th Oct., 1886	3 years	...	
McCulloch, Andrew Lake	Hawksville	6th Oct., 1886	H. J. Bowman, Berlin	30th June, 1887	1 year	10th Nov., 1888	Grad. S.P.S., 1887
Rorke, Louis Valentine	Heathcote	5th Jan., 1887	Stewart & Whitson, Collingwo'd	5th Jan., 1887	3 years	14th Apr., 1890	
Taylor, Thomas Herbert	St.Jas.Pr'k, Lon.	5th April, 1887	C. A. Jones, London	16th June, 1887	3 years	...	
Weekes, Abel Seneca	Glencoe	5th April, 1887	Coad & Robertson, Glencoe	15th April, 1887	3 years	12th Apr., 1890	
Griffin, Albert Dyke	Woodstock	7th Nov., 1887	W. M. Davis, Woodstock	7th Nov., 1887	3 years	11th Nov., 1890	
Kirkpatrick, Robert	London	9th Nov. 1887	...	...	...	...	
Gibson, Harold Holmes	Willowdale	4th April, 1888	P. S. Gibson, Willowdale.	4th April, 1888	3 years	8th Sept., 1891	
Knight, Merle Shafto	Woodstock	4th April, 1888	...	...	...	...	
Moore, Thomas Alexander	London	4th April, 1888	J. M. Moore, London	9th April, 1888	3 years	12th Nov., 1892	
Ollerhead, George Elliott	Brampton	5th April, 1888	C.J.&C.R Wheelock, Orangev'le	12th April, 1888	3 years	...	
Robinson, John Kimpton	Essex Centre	5th April, 1888	J. S. Laird, Essex Centre	7th April, 1888	3 years	11th Apr., 1891	Dead.

LIST OF CANDIDATES who have passed the Preliminary Examinations for Land Surveyors in Ontario—*Continued.*

NAME OF CANDIDATE.	ADDRESS.	Date of Preliminary Certificate.	TO WHOM ARTICLED.	DATE.	Term of Service	Date of Final Exam.	GENERAL REMARKS
McMullen, William Ernest	Toronto	6th Nov., 1888	Speight & VanNostrand, Tor.	6th Nov., 1888	3 years	11th Nov., 1892	
Naismith, Peter Lawrence	Pembroke	6th Nov., 1888					
Wallace, Charles Hugh	Port Arthur	6th Nov., 1888	H. DeQ. Sewell, Port Arthur	6th Nov., 1888	1 year	9th Nov., 1889	B.E. Trin. Col. Dub
Anderson, John Drummond	Delaware	1st April, 1889	J. A. Bell, St. Thomas	3rd April, 1889	3 years	13th Apr., 1892	
O'Hara, Walter Francis	Chatham	1st April, 1889	A. McDonell, Chatham.	3rd April, 1889	3 years	14th Apr., 1892	
Bowman, Leander Meyer	Lindsay	2nd April, 1889	A. M. Bowman, Lindsay	2nd April, 1889	2 y. 5 m	14th Apr., 1892	
Harvey, Thomas Alexander	London	2nd April, 1889	J. M. Moore, London	9th April, 1889	4 years		
Heathcote, Wm. C. Percival	Peterboro'	2nd April, 1889					
Sharpe, Geo. Alexander	Cannington	2nd April, 1889	John Vicars, Cannington	7th April, 1889	3 years		
Watson, John	Orillia	3rd April, 1889	C. E. Fitton, Orillia	10th April, 1889	3 years	13th Apr., 1892	
McLennan, Murdoch John	Williamstown	9th Nov., 1889	D. R. Brown, Cornwall	5th Oct., 1891	1 year		B.A. Sc., (McGill)
Grenfell, Joseph Henry	London	9th April, 1890	J. M. Moore, London	19th April, 1890	4 years		
Hill, Victor	Toronto	9th April, 1890	V. M. Roberts, Toronto Junc.	9th April, 1890	3 years		
McFarlane, Malcolm Cameron	Brockville	9th April, 1890	B. J. Saunders, Brockville	6th Aug., 1890	1 year		B.A. Sc., (McGill)
Mackenzie, Wm. Innes, jun.	Toronto	5th Nov., 1890	Speight & VanNostrand, Tor.	5th Nov., 1890	3 years		
Munro, John Vicar	London	5th Nov., 1890	F. Henry, London	10th Mar., 1890	3 years		
Farncomb, Ernest Alfred	London	7th April, 1891	F. W. Farncomb, Exeter	2nd May, 1891	3 years		
Hall, Walter	London	7th April, 1891					
McCubbin, George Albert	St. Thomas	5th April, 1892	A. W. Campbell, St. Thomas	6th April, 1892	3 years		
Abrey, George Spencer	Toronto Junct'n	9th Nov., 1892	G. B. Abrey, Toronto Junction	9th Nov., 1892	3 years		
Code, Abram Silas	Glencoe	9th Nov., 1892	Coad & Robertson, Glencoe	9th Nov., 1892	3 years		
Hopkins, Marshall Willard	Stony Creek	9th Nov., 1892	Cyrus Carroll, Hamilton	9th Nov., 1892	1 year		B.A. Sc., (McGill)
Bolton, Ellsworth Doan	Listowel	5th April, 1893	L. Bolton, Listowel	6th April, 1893	1 year		B.A. Sc., (McGill)
Richardson, Jocelyn Johnston	St. Catharines	8th April, 1893	E. Gardiner, St. Catharines	20th May, 1893	3 years		

LIST OF MEMBERS.

Names marked thus * were granted exemption under authority of Sub-sec. 4 of Sec. 10 of the Ontario Land Surveyors' Act; and those marked † registered, but withdrew from practice.

Abrey, George Brockitt	Toronto Junction.
Aylsworth, Wm Robert	Box 2, Belleville.
Aylsworth, John S	Selby.
Aylsworth, Charles Fraser, Sr.	Madoc.
Aylsworth, Charles Fraser, Jr	Box 60, Madoc.
Beatty, David	Parry Sound.
Beatty, Walter	Delta.
Bell, James Anthony	St. Thomas.
Bowman, Clemens Dersteine	West Montrose.
Browne, Harry John	17 Toronto Street, Toronto.
Burke, Wm. Robert	Ingersoll.
Butler, Matthew Joseph,	Box 359, Napanee.
Bray, Edgar	Oakville.
Barrow, Ernest George	Hamilton.
Bolger, Francis	Penetanguishene.
†Bowman, Leander Meyer	Medical Health Dept., Toronto.
†Bowman, Franklin Meyer	Berlin.
†Bowman, Arthur Meyer	Berlin.
Baird, Alexander	Leamington.
Bazett, Edward	Burks Falls.
Browne, Wm. Albert	17 Toronto Street, Toronto.
Biggar, C. A.	68 Daly Ave., Ottawa.
Bray, Samuel	Department of Indian Affairs, Ottawa.
Bolton, Lewis	Listowel.
Brown, David R	Cornwall.
Bowman, Herbert Joseph,	Berlin.
Brown, John Smith	Kemptville.
Bolton, Jesse Nunn	264 Major St., Toronto.
Bolger, Thomas Oliver	City Eng. Office, Kingston.
Bell, Andrew	Almonte.
Campbell, Archibald Wm.	St. Thomas.
Cavana, Allan George	Orillia.

†Cambie, H. J .... Vancouver, B.C.
Chipman, Willis .... 103 Bay St., Toronto.
Coad, Richard .... Glencoe.
Cheesman, Thos .... Mitchell.
Caddy, Cyprian Francis .... Campbellford.
Carre, Henry .... Belleville.
Cameron, Alfred John .... Peterborough.
Caddy, John St. Vincent .... 559 King St., Ottawa.
Casgrain, Joseph Philip Bâby .... Morrisburg.
Carroll, Cyrus .... 6½ James Street S., Hamilton.
Creswicke, Henry .... Barrie.
*Cromwell, Jos. M. Oliver .... Perth.
†Coleman, R. H .... 204 King St. E., Toronto.
Cozens, Joseph .... Sault Ste. Marie.

Doupe, Joseph .... 411 Main Street, Winnipeg.
Dickson, James .... Fenelon Falls.
DeGursé, Joseph .... Windsor.
DeMorest, Richard Watson .... Sudbury.
Davidson, Walter Stanley .... Arkona.
Dobbie, Thomas William .... Tilsonburg.
†Drewry, W. S. .... Ottawa.
Deacon, Thomas Russ .... Rat Portage.
Deane, Michael .... Lindsay.
Davis, William Mahlon .... Woodstock.
Ducker, W. A. .... 314 McWilliam St., Winnipeg, Man.
Davis, John .... Alton.
Deans, William J. .... Oshawa.

Evans, John Dunlop .... Copper Cliff, near Sudbury.
Esten, Henry Lionel .... 157 Bay Street, Toronto.
Ellis, Henry Disney .... City Hall, Toronto.

Fawcett, Thomas .... Dept. of Interior, Ottawa
Foster, Frederick Lucas .... 157 Bay Street, Toronto
Fitton, Charles Edward .... Orillia.
Flater, Frederick William .... Chatham.
Fairbairn, Richard Purdom .... 127 Major St., Toronto.
Francis, John James .... Sarnia.
*Fraser, Charles .... Wallaceburg.
Farncomb, Frederick William .... 213 Dundas St., London.
Fitzgerald, James William .... Box 333, Peterborough.

Gaviller, Maurice	Box 773, Collingwood.
Gardiner, Edward	St. Catharines.
Gibson, Peter Silas	Willowdale.
Gibbons, James	Renfrew.
Gamble, Killaly	193 Bloor St. E., Toronto.
Gibson, Harold Holmes	Willowdale.
Galbraith, William	Bracebridge.
Griffin, Albert Dyke	Woodstock.
†Green, T. D	Dep. Ind. Affairs, Ottawa.

†Harris, John Walter	Winnipeg.
Henderson, Eder Eli	Henderson P.O., Maine, U.S.A.
Hart, Milner	103 Bay St., Toronto.
Hutcheon, James	Guelph.
Howitt, Alfred	Gourock.
Haskins, William	45 Wellington St. S., Hamilton.
Hanning, Clement George	Preston.
Hobson, Joseph	Engineer's Office, G. T. Ry., Hamilton.
Hewson, Thomas Ringwood	Peterborough.

Innes, William Livingstone	London.

Jones, Thomas Harry	Brantford.
Johnson, Robert Thornton	Sudbury.
James, Silas	19 Richmond St. E., Toronto.
James, Darrell Denman	19 Richmond St. E., Toronto.
Jones, John Henry	Sarnia.
Jones, Charles Albert	213 Dundas St., London

Kirkpatrick, George Brownly	Crown Lands Dept., Toronto.
Klotz, Otto Julius	Dept. of Interior, Ottawa.
Kennedy, James H	Box 434, St. Thomas.
Kippax, Hargreaves	South Dakota, Huron.
*Kirk, Joseph	Stratford.

Lumsden, Hugh David	7 Homewood Ave., Toronto.
Lewis, J. B	Brunswick House, Ottawa.
Lendrum, Robert Watt	Vankleek Hill.
Laird, Robert	City Hall, Toronto.
Laird, James Steward	Essex Centre.
*Lynch-Staunton, F. H	Hamilton.
†Livingstone, T. Chisholm	Winnipeg.

Lougheed, A. .... Port Arthur.
Low, Nathaniel E. .... Wiarton.

McGeorge, William Graham .... Chatham.
McPhillips, George .... Box 556, Windsor.
McAree, John .... Toronto.
McKay, Owen .... Windsor.
McCulloch, Andrew Lake .... Toronto Junction.
McFarlen, George Walter .... Court House, Toronto.
McDowall, Robert .... Owen Sound.
McMullen, Wm. Ernest .... 7 Murray Street, Toronto.
McEvoy, Henry Robinson .... St. Mary's.
McLatchie, John .... 28 Stanley Ave., Ottawa.
McFadden, Moses .... Neepawa Manitoba.
McKenna, John Joseph .... Dublin.
McDonell, Augustine .... 4 and 5 Ebert's Block, Chatham.
McGrandle, Hugh .... Huntsville.
McLean, James Keachie .... Elora.
McCallum, James .... Rat Portage.

MacKenzie, William Lyon .... Mattawa.
†MacLeod, Henry A. F. .... 340 Cooper St., Ottawa.
†MacPherson, Duncan .... C. P. Ry., Montreal.
Macdougall. A. H .... Port Arthur.
Macnabb, John Chisholm .... Chatham.

Moore, J. Harry .... Smith's Falls.
Manigault, William Mazyck .... Box 300, Strathroy.
Murphy, Charles Joseph .... 157 Bay St., Toronto.
Mountain, George Alphonse .... Ottawa.
Malcolm, Sherman .... Blenheim.
Moore, Thomas Alexander .... London South.
Morris, James Lewis .... Pembroke.
Miles, Charles Falconer .... 8 Lombard St., Toronto.
Marshall, James .... Holyrood.

Niven, Alexander .... Haliburton.
Newman, William .... Windsor.

Ogilvie, William .... Ottawa.
O'Hara, Walter Francis .... Chatham.

Patten, Thaddeus James	Little Current.
Paterson, Jas. Allison	9 Masonic Chambers, Toronto.
†Pearce, William	Calgary Alta.
†Pedder, James Robert	Doon.
Pinhey, C. H.	Coteau Landing, Que.
Proudfoot, Hume Blake	33 Tranby Ave., Toronto.
Purvis, Frank	Eganville.

Robertson, James	Glencoe.
Ross, George	Welland.
Roberts, Vaughan Maurice	11 Peter St., Toronto.
Rorke, Louis Valentine	Sudbury.
*Robinson, William	London.
†Rogers, Richard Birdsall	Peterborough.
Russell, Alexander Lord	Port Arthur.
Reid, James Hales	Bowmanville.
Roger, John	Mitchell.
Reilly, William R.	Regina, Assa.
Ritchie, Nelson T.	Kincardine.

*Schofield, Milton C	Guelph.
Speight, Thomas Bailey	Yonge Street Arcade, Toronto.
†Spry, William	15 York St., Toronto.
Stewart, Elihu	Collingwood.
*Strange, Henry	Rockwood.
†Stewart, Louis Beaufort	S. P. S., Toronto.
Smith, Henry	Crown Lands Dept., Toronto.
Scane, Thomas	Ridgetown.
Saunders, Bryce Johnston	Box 114, Brockville.
Steele, Edward Charles	Toronto.
Seager, Edmund	Rat Portage.
Stewart, Walter Edgar	Aylmer, Ont.
Sankey, Villiers	City Hall, Toronto.
Sewell, Henry DeQuincey	Port Arthur.
Sanderson, Daniel Leavens	Wilton.
Silvester, George Ernest	Ringwood.
Smith, George, Jr	Beaverton.
†Sherman, Ruyter S	Vancouver, B.C.
Sing, Josiah Gershom	Box 3, Meaford.
†Strathern, John	Vancouver, B. C.

Tyrrell, James Williams .... 42 James St. N., Hamilton.
Tiernan, Joseph M .... Tilbury Centre.
†Tracy, Thos. H .... Vancouver, B.C.
Traynor, Isaac .... Dundalk.
Turnbull, Thomas .... C. P. R. Office, Winnipeg.

Unwin, Charles .... 157 Bay Street, Toronto.
Ure, Frederick J .... Woodstock.

VanNostrand, Arthur J .... Yonge Street Arcade, Toronto.
VanBuskirk, W. F .... Stratford
†Vicars, John .... Kamloops, B.C.

Wicksteed, Henry King .... Cobourg.
Weatherald, Thomas .... Box 273, Goderich.
Wheelock, Chas. Richard .... Orangeville.
Warren, James .... Walkerton.
Wilkie, Edward Thomson .... Carleton Place.
Walker, Alfred P .... C. P. R. Eng. Dept., Toronto.
Wadsworth, Vernon B .... 103 Bay St., Toronto.
Williams, David .... Kingston.
Wallace, Charles Hugh .... Hamilton.
Watson, John McCormack .... Box 224, Orillia.
Wiggins, Thomas H. .... Napanee.
Weekes, Abel Seneca .... Clinton.
Whitson, James Francis .... Crown Lands Dept., Toronto.
†Wheeler, Arthur O .... New Westminster, B.C.
Wilkins, Frederick W .... 372½ Water St., Peterborough.
Winter, Henry .... Thornyhurst.
†Willson, Alfred .... 204 King St. East, Toronto.
*Wood, H. O. .... Billing's Bridge.

Yarnold, William Edward .... Port Perry.

LIST OF THOSE WHO HAVE PAID $1.00, WITH REQUEST TO REGISTER, BUT HAVE NOT REQUESTED TO HAVE THEIR NAMES WITHDRAWN.

Bray, Harry F	Oakville.
Caddy, E. C.	Cobourg.
Davidson, Alexander	Arkona.
Davis, A. R	Napanee.
Fowlie, Albert	Orillia.
Gibson, George	St. Catharines.
Graydon, Aquila Ormsby	London.
Hermon, R. W	Rednersville.
McNab, J. D.	Owen Sound.
Murdock, William	Port Arthur.
Pope, Robert T	Magnetawan.
Rubidge, Tom S	Cornwall.
Ross, J. E	Box 207, New Westminster, B.C.
Stewart, John	Ottawa.
Thomson, A. Clifford	Kansas City, Mo.
Walsh, T. W	Simcoe.

D.W. Smith
Sur Genl.
Upper Canada

1792-1804.

PROCEEDINGS

OF THE

ASSOCIATION OF

ONTARIO LAND SURVEYORS

AT ITS SECOND ANNUAL MEETING, SINCE INCORPORATION,

HELD AT TORONTO, FEBRUARY 27TH AND 28TH,
AND MARCH 1ST,

1894

Being the Ninth Annual Meeting of the Association of Provincial Land Surveyors of Ontario.

The Third Annual Meeting (Tenth Annual Meeting of the Association of Provincial Land Surveyors of Ontario) will be held in Toronto, commencing on Tuesday, 26th of February, 1895.

PRINTED FOR THE ASSOCIATION
BY
C. BLACKETT ROBINSON, 5 JORDAN STREET,
TORONTO.

PATRONIZE OUR ADVERTISERS.

NOTICES.

The attention of the members is called to the list of Standing and Special Committees as given on page 6. Each member should assist the Committees as much as possible.

Members can be supplied with copies of the Proceedings for 1886, 1887, 1888, 1889, 1890, 1891, 1892, or 1893 by remitting fifty cents to the Secretary.

Copies of the Ontario Land Surveyors' Act, and By-Laws of the Association will be sent upon receipt of three-cent stamp.

PATRONIZE OUR ADVERTISERS.

PREFACE.

To the Members of the Association of Ontario Land Surveyors.

The Proceedings of the Association at its Second Annual Meeting since incorporation are herewith presented.

Appended will be found By-laws passed since the publication of the last Annual Proceedings.

Each member is requested to remember, that the success of an Annual Meeting depends largely upon the exertions of individual members to produce an interesting programme.

Respectfully submitted on behalf of the Council,

A. J. VanNOSTRAND,
Secretary.

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ASSOCIATION OF

ONTARIO LAND SURVEYORS

(Incorporated 1892).

ORGANIZED 23RD FEBRUARY, 1886.

Officers for 1894-95.

PRESIDENT.

M. J. Butler, O.L.S., Napanee.

VICE-PRESIDENT.

M. Gaviller, O.L.S., Collingwood.

CHAIRMAN OF COUNCIL.

Villiers Sankey, O.L.S., Toronto.

SECRETARY-TREASURER.

A. J. VanNostrand, O.L S., Toronto.

COUNCILLORS.

Hon. A. S. Hardy, Commissioner of Crown Lands.
Villiers Sankey, Toronto }
H. J. Bowman, Berlin } For 3 years.
G. B. Kirkpatrick, Toronto }
A. Niven, Haliburton } For 2 years.
P. S. Gibson, Willowdale }
Willis Chipman, Toronto } For 1 year.

AUDITORS.

F. L. Foster, O.L.S., Toronto.
H. B. Proudfoot, O.L.S., Toronto.

BANKERS.

Imperial Bank of Canada (Yonge Street Branch, Toronto).

BOARD OF EXAMINERS.

V. Sankey, Toronto (Chairman).

G. B. Kirkpatrick, Toronto	Appointed by Lieut-Gov. in Council.
M. J. Butler, Napanee	
M. Gaviller, Collingwood	For 3 years, appointed by Council
R. Coad, Glencoe	
P. S. Gibson, Willowdale	For 1 year, appointed by Council.
A. Niven, Haliburton	

STANDING COMMITTEES FOR 1894-95.

Land Surveying.—T. B. Speight (Chairman), C. E Fitton, Wm. Galbraith, J. L. Morris, L. V. Rorke, B. J. Saunders, J. M. Tiernan, I. Traynor, C. Unwin.

Drainage.—Geo. Ross (Chairman), A. Baird, D. R. Brown, W. R. Burke, A. G. Cavana, R Coad, C. A. Jones, C. F. Miles, H. Winter.

Engineering.—T. H. Jones (Chairman), G. B. Abrey, A. W. Campbell, W. M. Davis, J. McAree, R. McDowall, O. McKay, J. Robertson, H. K. Wicksteed.

Entertainment.—F. L. Foster (Chairman), H. D. Ellis, M. W. Hopkins, W. E. McMullen, C. F. Miles, C. J. Murphy, H. B. Proudfoot, T. B. Speight, A. P. Walker.

Publication.—K Gamble (Chairman), H. J. Browne, W. Chipman, H. L. Esten, F. L. Foster, J. McAree, C. J. Murphy.

Topographical Surveying —Willis Chipman (Chairman), J. P. B. Casgrain, J. Cozens, J. Dickson, T. Fawcett, O. J. Klotz, W. Ogilvie, A. L. Russell, E. Stewart, J. W. Tyrrell.

SPECIAL COMMITTEES.

Polar Research.—Willis Chipman (Chairman), W. Ogilvie, O. J. Klotz, J. W. Tyrrell, L. B. Stewart, M. J. Butler, J. McAree.

Standard Measures of Length —G. B. Abrey (Chairman), A. Niven, W. R. Burke, M. W. Hopkins, J. McAree, M. Gaviller.

Biography.—G. B. Kirkpatrick (Chairman), W. Chipman, H. L. Esten, W. R. Aylsworth.

PROGRAMME OF THE

Association of Ontario Land Surveyors

(INCORPORATED)

AT ITS SECOND ANNUAL MEETING HELD IN TORONTO,
FEBRUARY 27TH AND 28TH, AND MARCH 1ST, 1894.

PROGRAMME.

Tuesday, February 27th—Morning, 10 o'clock.

Meeting of Council.
Meetings of Standing Committees.

Afternoon, 2 o'clock.

Reading of Minutes of previous meeting.
Reading of Correspondence and accounts.
Report of Council of Management.
President's Address.
Paper—"The Eskimo," J. W. Tyrrell, O.L.S., C.E., Hamilton.
Paper—"House Drainage," M. W. Hopkins, O.L.S, C.E., Hamilton.

Evening, 8 o'clock.

Paper—"Lake of the Woods as a Mining Camp," Henry DeQ. Sewell, O.L.S., C.E., Port Arthur.
Paper—"Annuities," M. J. Butler, O L.S., C E, Napanee.

Wednesday, February 28th—Morning, 10 o'clock.

Report of Committee on Drainage with "Question Drawer," H. J. Bowman, O.L S., C.E., Chairman.
Paper—"Pelee Island Drainage Works," Wm. Newman, O.L.S., C.E., Windsor.
Paper—"The Grand Bend Cut," R. Coad, O.L.S., C E., Glencoe.
Letter—"The Little Bear Creek Drain," W. G. McGeorge, O. L.S., C.E., Chatham.

Afternoon, 2 o'clock.

Report of Committee on Topographical Surveying, Willis Chipman, O.L.S., C.E., Chairman.

Report of Committee on Land Surveying, with "Question Drawer," M. Gaviller, O.L.S., Chairman.

Paper—"Nipissing and James' Bay Railway Survey," J. A. Paterson, O.L.S., C.E., Toronto.

Paper—"Descriptions of City Properties," T. B. Speight, O.L.S., Toronto.

Paper—"The New Regulation Mile Track of the Windsor Driving Park Association," O. McKay, O.L.S., C.E., Windsor.

Paper—"Photo-Topography," Otto J. Klotz, O.L.S., D.T.S., Ottawa.

Evening, 8 o'clock.

ANNUAL DINNER.

Thursday, March 1st—Morning, 10 o'clock.

Report of Auditors.

Paper—"Cedar, Macadam and Gravel Roadways," P. S. Gibson, O.L.S., C.E., Willowdale.

Paper—"Protection of the Source of the Owen Sound Waterworks System," R. McDowall, O.L S , C.E., Owen Sound.

Afternoon, 2 o'clock.

Ratification of New By-laws

Report of Committee on Publication, H. L. Esten, O.L.S., Chairman.

Report of Committee on Entertainment, F. L. Foster, O.L.S , Chairman.

Unfinished Business.

New Business.

Nomination of Officers (President, Vice-President, two Members of Council, Secretary-Treasurer and Auditors).

Appointment of Scrutineers.

Adjournment.

ASSOCIATION OF

ONTARIO LAND SURVEYORS

(INCORPORATED).

MINUTES OF THE SECOND ANNUAL MEETING

(Ninth Annual Meeting of Provincial Land Surveyors of Ontario),

FEBRUARY 27TH AND 28TH, MARCH 1ST, 1894.

The meeting was called to order at 2 p.m. on Tuesday, the 27th of February, in the lecture room of the Canadian Institute, 58 Richmond Street East, Toronto.

The President, Mr. Elihu Stewart, in the chair.

Moved by Mr. VanNostrand, seconded by Mr. Niven: That the minutes of the last meeting of the Association of Ontario Land Surveyors, as printed in the Proceedings, be confirmed as read. Carried.

The Secretary read letters from Messrs. J. W. Fitzgerald, Peterborough, and Joseph Kirk, Stratford, expressing regret at their inability to attend the meeting.

The President then delivered his Annual Address.

Mr. J. W. Tyrrell, of Hamilton, read a paper prepared by him, entitled "The Eskimo."

Moved by Mr. Sankey, seconded by Mr. Niven: That Mr. Tyrrell's paper on "The Eskimo" be received, and the thanks of the Association tendered him for the same. Carried.

A paper on "House Drainage," prepared by Mr. M. W. Hopkins, of Hamilton, was read by Mr. Sewell, owing to Mr. Hopkins' absence.

Moved by Mr. Tyrrell, seconded by Mr. Gibson: That Mr. opkins' paper on "House Drainage" be received, and the thanks of e Association tendered him. Carried.

A discussion took place on some questions submitted to the Land Surveying Committee; after which the report of the Committee on Topographical Surveying was read by Mr. Willis Chipman, Chairman of the Committee.

On motion of Mr. Foster the meeting then adjourned. 5.15 p.m.

TUESDAY EVENING SESSION.

Business was resumed at 8 p.m., the President in the chair.

Mr. Henry DeQ. Sewell read a paper on "Lake of the Woods as a Mining Camp."

Moved by Mr. Tyrrell, seconded by Mr. Wilkie: That Mr. Sewell's paper be received, and that the thanks of the Association be tendered him. Carried.

Mr. J. D. Evans read a paper on "The Genesis and Development of Mining in the Sudbury District."

Moved by Mr. Gaviller, seconded by Mr. Niven: That Mr. Evans' paper be received, and the thanks of the Association tendered him. Carried.

A discussion, introduced by Mr. Gaviller, then took place, as to the employment of unlicensed surveyors, which, it was alleged, was carried on to a considerable extent in some parts of the province.

The Secretary, having received a copy of a memorial from the Provincial Land Surveyors' Association of Manitoba to the Dominion Government, asking that the duty on surveying instruments be reduced, it was moved by Mr. Sankey, seconded by Mr Niven: That the Secretary be instructed to forward a memorial to the Minister of Finance in Ottawa, on the same lines as the one presented by the Manitoba Association; and also that the co-operation of the other Surveyors' Associations in Canada and the Society of Civil Engineers be asked. Carried.

On motion of Mr. Niven the meeting was adjourned. 10 p m.

WEDNESDAY MORNING SESSION.

Business was resumed at 10 a.m., the Vice-President, Mr. M. J. Butler, in the chair.

The report of the Committee on Drainage was read by Mr. H. J. Bowman, Chairman of the Committee, and discussed at some lengt its adoption being deferred until the arrival of Mr. McGeorge, w was expected at the meeting.

A paper, prepared by Mr. Wm. Newman of Windsor, on "Pelee Island Drainage Works," was read by Mr. Wilkie, Mr. Newman not being able to attend the meeting.

The President, Mr. Stewart, having arrived, took the chair.

Moved by Mr. Bowman, seconded by Mr. Gibson: That Mr. Newman's paper be accepted, and the thanks of the Association given him for the same. Carried.

Mr. R. Coad, of Glencoe, read a paper on "The Grand Bend Cut."

Moved by Mr. Ellis, seconded by Mr. Ross: That the paper be received, and the thanks of the Association tendered Mr. Coad. Carried.

Mr. M. J. Butler then read a paper on "Annuities," for which, on motion of Mr. Sankey, seconded by Mr. Ellis, he received the thanks of the Association.

Mr H. J. Bowman read a letter received from Mr. W. G. McGeorge, of Chatham, giving a description of the Little Bear Creek Drain.

Moved by Mr. Ross, seconded by Mr. Sewell: That the letter of Mr. McGeorge be received, and the thanks of the Association tendered him for the same. Carried.

The meeting then adjourned. 12.45 p.m.

WEDNESDAY AFTERNOON SESSION, 2 O'CLOCK.

The President in the chair.

The report of the Committee on Drainage not having been disposed of at the morning session, it was then taken up, and on motion of Mr. Bowman, seconded by Mr. Wilkie, was received and adopted.

A question which had been submitted to the committee for solution was also discussed at the same time.

Mr. Paterson read a paper on "Nipissing and James' Bay Railway Survey."

Moved by Mr. Tyrrell, seconded by Mr. Niven: That the paper be received, and the thanks of the Association tendered Mr. J. A. Paterson for the same. Carried.

The report of the Council of Management was then presented by the Chairman of the Council, Mr. Sankey, who moved its reception; after which it was discussed at length.

Moved by Mr Sankey, seconded by Mr. Sewell: That the report of the Council of Management be adopted. Carried.

Moved by Mr. Sankey, seconded by Mr. Chipman: That the thanks of this Association be tendered to the Iowa Society of Civil Engineers and Surveyors, for their kindness in sending the extra copies of their report without cost; also to the editor of the *Surveyor*, London, England, for the gift of a volume containing issues of that paper from January to June, 1893 ; also for weekly issues subsequently received. Carried.

Moved by Willis Chipman, seconded by G. B. Abrey: That the question of reducing the expenditure *re* Examinations be referred back to the Council to report at the next annual meeting ; but that the Council be urged to reduce the expenses as much as possible in the meantime. Carried.

Moved by Mr. Sankey, seconded by Mr. Gibson: That By-laws Nos. 33 and 34, as passed by the Council, be ratified. Carried.

Moved by Mr. Ross, seconded by Mr. Paterson : That the Council is hereby requested to procure from our exchange societies a sufficient number of copies to afford a complete set to each of our members at a minimum cost. Carried.

The report of the Committee on Land Surveying was then read by Mr. Gaviller, Chairman of the Committee, and the answers of the Committee to the questions submitted to them.

Moved by Mr. Chipman, seconded by Mr. Tyrrell : That the report of the Committee on Land Surveying be adopted, and that a copy of the same be sent to each member of the Association on or before September 15th, 1894. Carried.

Mr. O. McKay, of Windsor, read a paper on " The New Regulation Mile Track of the Windsor Driving Park Association," which, on motion of Mr Sankey, seconded by Mr. Gibson, was received, and the thanks of the Association tendered Mr. McKay.

Mr. Speight read a paper on " Descriptions of City Properties."

Moved by Mr. Sankey, seconded by Mr. Wilkie: That Mr. Speight's paper be received, and the thanks of the Association tendered him. Carried.

A paper prepared by Mr. Otto J. Klotz, of Ottawa, on " Photo-Topography," was read by Mr. M. J. Butler, Mr. Klotz not being in attendance at the meeting.

Moved by Mr. Niven, seconded by Mr. Foster : That the paper be received, and the thanks of the Association tendered Mr. Klotz for the same. Carried.

It being 6 o'clock, the meeting adjourned.

The Annual Dinner took place in the evening (see report of Entertainment Committee).

THURSDAY MORNING SESSION.

Business was resumed at 10 a.m., the Vice-President, Mr. M. J. Butler, in the chair.

The report of the Auditors was read, and, on motion of Mr. Sewell, seconded by Mr. McAree, adopted.

Mr. G. B. Abrey, Chairman of the Committee on Engineering, announced that no questions had been submitted to them, and the Committee were not prepared to make a report.

Mr. P. S. Gibson read a paper on "Cedar, Macadam and Gravel Roadways."

Moved by Mr. Niven, seconded by Mr. Sewell: That Mr. Gibson's paper be received, and that he be tendered the thanks of the Association for it. Carried.

Mr. R. McDowall read a paper on "Protection of the Source of the Owen Sound Water Works System," which, on motion of Mr. Hopkins, seconded by Mr. Gibson, was received, and the thanks of the Association tendered Mr. McDowall.

The following resolution was then carried: Moved by Mr. Willis Chipman, seconded by John McAree: Whereas the northerly part of the Dominion of Canada has not as yet been thoroughly explored, and its valuable resources are not as yet an available asset; and, whereas other nations are turning their attention to this part of our country with views of expropriation; therefore the Association of Ontario Land Surveyors at this meeting deems it desirable that a Special Committee be appointed for the following purposes:—1st, To report upon the most economical methods of surveying and marking, by permanent monuments, a meridian line to serve as a basis for future surveys and explorations, this line to be run north from some point on the north-westerly shore of Baffin's Bay in the Dominion of Canada. 2nd, To give an estimate of the probable cost of such a survey. 3rd, To recommend some practical scheme for defraying the cost of the work. And that Messrs. William Ogilvie, O. J. Klotz, J. W. Tyrrell, L. B. Stewart, M. J. Butler, and the mover and seconder be and are hereby appointed as such Committee to submit a report at the next Annual Meeting of this Association.

The question of preparing papers for the next meeting having been introduced, a number of subjects were suggested to assist the Secretary in preparing the programme, and "Our Standards of Measurement" being one of them, suggested by the Chairman, a discussion took place on that subject.

Moved by Mr. Chipman, seconded by Mr. Sewell, and resolved: That a Committee be formed for the purpose of reporting on our Standard Measures; and that the members of it be Messrs. Abrey, Niven, Burke, Hopkins, McAree and Gaviller. Carried.

The meeting then adjourned. 12.30 p.m.

THURSDAY AFTERNOON SESSION.

Business was resumed at 2 p.m., the President in the chair.

The report of the Committee on Publication was read by Mr. Speight, in the absence of Mr. Esten, the chairman of that Committee, and on motion was adopted.

Moved by Mr. VanNostrand, seconded by Mr. Speight: That the report of the Committee on Entertainment be received as read and printed in the Proceedings. Carried.

In reply to an enquiry from Mr. Chipman, as to inviting representatives from other societies to attend the annual meeting, the Secretary said that he had sent such an invitation to each of the exchange societies, but had received replies from only two, Ohio and Michigan, and they stated they were unable to get any one who could leave his business for such a length of time. A representative, Mr. A. J. McPherson, had been in attendance from the Ontario School of Practical Science, however, during the whole meeting.

Moved by P. S. Gibson, seconded by M. J. Butler: That we have to regret the death, since our last meeting, of Mr. Thomas Fraser Gibbs, whose obituary appears in our published report of Proceedings for 1893; and we desire to convey to his family this expression of sympathy with them in their bereavement; and that the Secretary be instructed to forward to them a copy of this resolution. Carried.

Moved by Mr. Sankey, seconded by Mr. Abrey: That the President appoint a committee to collect information regarding the appointment, practice and history of the early surveyors of this Province, and present the same at the next annual meeting, so that a synopsis may be published in the reports. Carried.

The President then appointed the following gentlemen to act as such committee, with power to add to their numbers:—Messrs. Chipman, Kirkpatrick, Esten, and W. R. Aylesworth.

Moved by Mr. Speight, seconded by Mr. Murphy: That any omissions or clerical errors in the record of the proceedings of this meeting, now in the hands of the stenographer and the secretary, be corrected by the Committee on Publication before being printed. Carried.

Before beginning the nomination of officers for the ensuing year, on motion of Mr. Van Nostrand, seconded by Mr. Gibson, the meeting adjourned for 10 minutes.

On re-assembling, Mr. Gibson moved, seconded by Mr. McAree: That Mr. M. J. Butler be President for the ensuing year.

There being no further nominations, Mr. Butler was declared elected.

For the office of Vice-President, Mr. M. Gaviller was nominated by Mr. Sankey, seconded by Mr. Niven; and as there were no other nominations he also was declared elected.

Mr. Gaviller, being a member of the Council and having still one year to complete his term as such, thereupon resigned his position on the Council, which made the election of three Councillors necessary. The following were the nominations for the Council, the retiring members being Messrs. McAree, Sankey and Gaviller:—

Mr. Chipman, nominated by Mr. Butler.
Mr. Speight, nominated by Captain Gamble.
Mr. H. J. Bowman, nominated by Mr. Speight.
Mr. John D. Evans, nominated by Mr. Sankey.
Mr. E. T. Wilkie, nominated by Mr. McAree.
Mr. V. Sankey, nominated by Mr. Niven.
Mr. McAree, nominated by Mr. Tyrrell.
Mr. Henry Winter, nominated by Mr. McAree.
Mr. J. W. Tyrrell, nominated by Mr. Wilkie.
Mr. R. Coad, nominated by Mr. Niven.
Mr. W. R. Burke, nominated by Mr. Chipman.

Mr. E. Stewart, the retiring President, was nominated by Mr. Gibson, but asked to have his name withdrawn, which was accordingly done.

The President then appointed Mr. H. J. Browne and Captain Gamble scrutineers for the ensuing year.

Moved by Mr. Sankey, seconded by Mr. McAree: That Mr. A. J. VanNostrand be re-elected Secretary-Treasurer for the ensuing year. Carried.

Moved by Mr. Chipman, seconded by Mr. Niven: That the Secretary-Treasurer be paid the sum of $120 for his services during the past year. Carried.

The following were then nominated for the position of Auditor, two being required:—

Mr. G. B. Abrey, nominated by Mr. Niven.
Mr. Foster, nominated by Mr. Gaviller.
Mr. Traynor, nominated by Mr. Gaviller.
Mr. Hopkins, nominated by Mr. Speight.
Mr. Proudfoot, nominated by Mr. Niven.
Mr. T. Harry Jones, nominated by Mr. Chipman.

Mr. G. B. Abrey asked to have his name withdrawn, which was accordingly done.

Moved by Mr. Gaviller, seconded by Mr. Traynor: That the Chairman do now leave the Chair, and that Mr. Gibson take the Chair. Carried.

Mr. Gaviller then, seconded by Mr. Niven, moved a cordial vote of thanks to Mr. Stewart, the retiring President, for his services to the Association, which was carried by a standing vote, and to which Mr. Stewart made the following reply:—

MR. CHAIRMAN AND GENTLEMEN,—I thank you sincerely for this expression of your feelings towards me. I appreciate the honor of being a past president of the Association, but I appreciate this vote of thanks even more. It was said to-day that I was always giving "taffy" to the members, but I think you have been returning the compliment now. I certainly think, as I have said before, that it is a very strange thing that such a large body of men could so long work together so harmoniously. I never saw even a party of a dozen without there being some cranks, and I thought before that it was impossible to be without some who would be always trying to find fault. I have been in similar positions to this in other societies even with a much smaller membership, and I have generally noticed that a certain amount of jealousy and that sort of thing crept in, but I have never seen anything of the kind in this Association. I remember very well the first meeting to organize the old Association. We felt sanguine then that by union we could do more than we had done separately, but I don't know that any one expected that we should arrive at the status we now have. I thank you again, and if I can be of any service in future I shall be most happy to do so.

On motion of Mr. Butler, seconded by Mr. Chipman, the meeting was declared closed. 4 p.m.

MEMBERS IN ATTENDANCE AT THE SECOND ANNUAL MEETING.

Abrey, G. B.
Bowman, H. J.
Bray, E.
Browne, H. J.
Browne, W. A.
Burke, W. R.
Butler, M. J.
Chipman, W.
Coad, R.
Davis, J.
Ellis, H. D.
Esten, H. L.
Evans, J. D.
Foster, F. L.
Gamble, K.
Gaviller, M.
Gibson, H. H.
Gibson, P. S.
Hopkins, M. W.
Hutcheon, J.
James, D. D
Johnson, R. T
Jones, T. H.
Kirkpatrick, G. B
Lumsden, H. D.
McAree, J.
McDowall, R.
McKay, O.
McMullen, W. E.
Miles, C. F.
Murphy. C. J.
Niven, A.
Paterson, J. A.
Proudfoot, H. B.
Ross, G.
Sankey, V.
Saunders, B. J.
Sewell, H. DeQ.
Silvester, G. E.
Smith, H.
Speight, T. B.
Spry, Wm.
Stewart, E.
Stewart, L. B.
Traynor, I
Tyrrell, J. W.
Unwin, C.
Ure, F. J.
VanNostrand, A. J.
Walker, A. P
Whitson, J. F.
Wiggins, T. H.
Wilkie, E. T.

RESULT OF ELECTIONS.

President .... M. J. Butler .... (by acclamation).
Vice-President .... M. Gaviller .... (by acclamation).
Secretary-Treasurer ..... A J. VanNostrand .... (by acclamation).

Councillors elected for ensuing three years.

V. Sankey, H. J. Bowman.

Councillor for one year.

Willis Chipman.

Auditors for ensuing year.

F. L. Foster. H. B. Proudfoot.

I hereby declare the above named Councillors and Auditors elected.

A. J. VanNostrand,
Secretary-Treasurer.

Certified correct.

H. J. Browne,
Killaly Gamble.
Scrutineers of Ballots.

REPORT OF THE COUNCIL OF MANAGEMENT.

The Council of Management beg to submit the following report on the work of the past year, being the second Association year. At the April meeting, the Secretary was instructed to purchase extra copies of the exchanges so that each member may be furnished with a full set; from his report it will be seen that this has cost the sum of $58.13. The action of the Iowa Society of Civil Engineers and Surveyors in gratuitously furnishing the extra copies required, is greatly to be commended, and the Board would suggest that a resolution of thanks be forwarded to the Secretary thereof by our Secretary. The opinion of the Association is asked as to the advisability of this outlay.

With regard to bonds of the Secy.-Treas., amounting to $1.000, the President has reported that the same were received by him and are now deposited with the manager of the Yonge St. Branch of the Imperial Bank of Toronto and has produced a receipt, dated March 3rd, 1893. The Council after due consideration instructed the Secy.-Treas. to place the sum of $500 in the Savings Department of the Imperial Bank, Yonge St. Branch, Toronto.

The subjects for examination of candidates as prescribed by statute, and the marks to be obtained as submitted by the Board of Examiners, received careful consideration and were finally adopted as now printed in the By-Laws. The Council concurs in the recommendation of the Board with regard to the minimum marks for levelling, and would advise that they be reduced from 40 to 35.

The various standing Committees, as provided by By-Law No. 12, were appointed.

The Council passed the following By-Laws under the authority of By-Law No. 33, and now report the same for ratification, or otherwise, by the Association:—

By-Law No. 34.—"The following surveyors having duly registered and having proved to the satisfaction of the Council that they had been respectively in actual practice as duly authorized and qualified Land Surveyors for Ontario for a period of not less than 35 years prior to July 1st, 1892, are hereby placed on the list of registered surveyors for Ontario, and are exempt from the payment of further dues under the authority of sub-section 4 of section 10, Ontario Statutes, 1892, Chapter 34—viz.: Henry Strange, Milton C. Schofield, William Robinson, Joseph Kirk, Charles Fraser, Joseph M. O. Cromwell, H. O. Wood, F. H. Lynch-Staunton and E. C. Caddy."

By-Law No. 35—"The annual fees to this Association, paid by candidates who are admitted at the November examination in each year shall cover all annual dues for the remainder of such current Association year and for the Association year following the same."

The following resolutions were also adopted with regard to the registration of Surveyors who are not now practising in the Province, or who are living out of the Province, and others who through inadvertence failed to register in the prescribed time.

(*a*) "The Registrar is hereby instructed to admit to enrolment and withdrawal from the registered list of practitioners, any duly authorized Provincial Land Surveyor for Ontario, who shall make application for the same, prior to the first day of January, 1894, upon such applicant furnishing a declaration that he has not practised as a Land Surveyor since the passing of the Ontario Land Surveyors' Act, and upon the payment of one dollar with such application."

(*b*) "The Registrar is hereby instructed to admit to enrolment any duly authorized Provincial Land Surveyor for Ontario, who shall make application for the same prior to the first day of January, 1894, upon such applicant furnishing a declaration that he refrained from practising as a Land Surveyor during the first Association year (ending 1st April, 1893), and upon payment of five dollars with such application."

(*c*) "The Registrar is hereby instructed to admit to enrolment any duly authorized Provincial Land Surveyor for Ontario, who shall make application for the same prior to the first day of January, 1894, upon payment with such application of the sum of nine dollars, being the registration fee and annual dues for first and current Association years"

A resolution was also adopted instructing the Registrar to accept the fees for the current year, of any member who had registered prior to the first election, but who had not paid any annual fees since; on the member furnishing a declaration that he had not practised in Ontario during the previous years.

The Council think it wise to treat all these cases on their merits, and are glad to be able to report that the number of Surveyors now unregistered is very small. The Council would urge the members of the Association to do their utmost to get any Surveyors whom they may know to be unregistered, to become enrolled at once

With regard to the cost of the examinations, the Council wish to draw attention to the remarks made by the Board of Examiners in their report. The following are some of the points which should be considered in dealing with the matter :—

1. At present two examinations a year must be held, as provided by statute.

2. Each successful candidate must be sworn before the Board.

3. There are now 14 subjects for examination, in each of which an oral is necessary as well as a paper.

The following suggestions are submitted for consideration with a view to the reduction of the cost :—

1. Have only one examination in each year.

2. Have only three members of the Board present at each examination, but let them be summoned in turn, or as convenient.

3. Have the papers prepared by the other members, and the answers marked at their homes, afterwards to be returned to the Secretary, with any remarks they may see fit to make.

4. Arrange so that successful candidates may be sworn in before any Surveyor appointed by the Board, or before a County Judge ; the papers, etc., being filed, as at present, with the Provincial Secretary.

5. Reduce the fees payable to the examiners to $5.00 per diem, leaving the travelling and hotel charges as at present, and get the Government to regulate the amount of the annual grant, having regard to the number of candidates.

6. Pay the members a fixed sum for each paper prepared, and for each set of answers corrected.

The above suggestions are made for the consideration of the Association, but the Council would urge that they be carefully considered, and that no hasty action be taken thereon.

The report of the Board of Examiners is herewith presented, having been adopted by the Council ; also the report of the Sec.-Treas. The latter report will show what a large amount of work is done by that officer, and the Council take this opportunity of expressing their thanks to him for his uniform courtesy and untiring energy.

In order to relieve him of some of the labour, the Council think that an assistant Secretary should be appointed, who could give great assistance in the issuing of circulars and other routine work.

With regard to the tariff question, the Council are not yet in a position to report, and would ask for further time.

Respectfully submitted,

VILLIERS SANKEY,
Chairman of Council.

REPORT OF THE SECRETARY-TREASURER.

MR. CHAIRMAN,—I beg to submit the following report of the business of the Association between 27th February, 1893, and 26th February, 1894:—

The total number of those who have applied for registration is 246. Of this number 33 have "withdrawn from practice," and 9 have been exempted from dues under by-law. Eleven members are in arrears of dues for first and current association years, and thirty for one year only, but in both cases a large percentage of those so in arrears are practically retired from practice, out of the country, or had been Provincial Land Surveyors of thirty-five years' standing before the passing of the Ontario Land Surveyors' Act.

Through information, kindly furnished by members of the Association and others, I have ascertained that the majority of unregistered Provincial Land Surveyors whose names appear in the list at the Crown Lands Department have died, left the Province, or become engaged in other pursuits, so that the number of Provincial Land Surveyors still carrying on a practice without having become registered and thus "duly authorized to practise," may be assumed to be very small.

The instructions of the Council of Management to procure, if possible, from our exchange societies, a sufficient number of copies to afford a complete set to each member, when possible, were carried out. The additional expense thereby incurred amounted to \$58.13.

The Iowa Society of Civil Engineers and Surveyors generously furnished the required number without charge, the cost of those from our other exchanges varying from 16½ to 33⅓ cents per copy.

The following circulars have been issued :—

No. 8.	Ballot for 1893-4	200	copies
" 9.	Explanation of Ballot	200	"
" 10.	Announcement to unregistered Surveyors	150	"
" 11.	Surveyors' Register	300	"
" 12.	Announcement of Annual Meeting, 1894	300	"
" 13.	Programme for " " "	300	"

Of the 1000 copies of Annual Report for 1893, 971 were sent to exchanges, members, advertisers, libraries, newspapers, etc., and 29 remain on hand.

As the membership of all the societies with which we exchange, appears to be increasing it will be necessary to have 1,100 copies of the forthcoming report printed.

Letters and accounts sent from Secretary's office	775
Postal Cards	46
Letters and Postal Cards received	455

The average amount of postage per member is about 25 cents, being probably greater during this period of general financial depression that it would have been had our members' clients been in better circumstances.

I would respectfully request our members to carefully examine the advertisements appearing in our annual reports, when contemplating purchase of any of the articles there represented.

Our columns have been liberally patronized by advertisers, and we trust with good results.

The thanks of the secretary are due to the chairman of Council and the several standing committees, special efforts having this year been devoted by them to the work of their various departments.

Accompanying this report is a statement of the financial transactions of the Association during the past year, which when duly audited will be presented.

All of which is respectfully submitted,

A. J. VanNostrand,
Secretary-Treasurer.

STATEMENT OF RECEIPTS AND EXPENDITURES, BETWEEN 27TH FEBRUARY, 1893, AND 26TH FEBRUARY, 1894.

1892-3 RECEIPTS.

To Balance on hand 27th February, 1893		$715 37
" Amounts collected from advertisements in '93 Report		85 50
" Proceedings sold, one copy		50
" 18 Registration fees at $1.00	$18 00	
" 3 Balances of $1.00 each, dues for 1st Association year	3 00	
" 10 Annual dues for 1st Association year, $4	40 00	
" 156 " 2nd " "	624 00	
" 4 " 3rd " "	16 00	
		701 00
" Fees and dues tendered, subject to acceptance by Council		16 00
" Interest accrued on $500 deposited in Savings Bank		11 09
Total		$1,529 46

1892-3 EXPENDITURES.

By Postage		$ 66 75
" Printing Circulars, Stationery, etc		20 40
" Publishing Report of Proceedings '93 Annual Meeting		244 30
" Express, Freight and Cartage *re* Exchanges		12 04
" Customs Brokerage on Exchanges received		2 25
" " " for Export entries on Exchanges sent		75
" Amount paid to Secretary-Treasurer for 1892		120 00
" " Stenographer for '93 Meeting		35 00
" Rent of Rooms for '93 Meeting		10 00
" Amount paid as balance of Board of Ex's. account		215 10
" " Seal and Stamp		7 50
" Blank Books, Stationery and Binding Case		6 40
" Duty on volume of "The Surveyor,"		30
" Amount paid for extra numbers of Michigan exchange		18 33
" " Expenses of Council Meetings, April and November		17 40
" Balance on hand in Savings' account	$511 09	
" " " Current "	241 85	
Total balance		752 94
Total		$1,529 46

A. J. VANNOSTRAND,
Secretary-Treasurer.

TORONTO, 26th February, 1894.

REPORT OF AUDITORS.

We hereby certify that we have examined the accounts of the Secretary-Treasurer, and vouchers therefor, also Financial Statement, and have found them correct.

We find the expenditure of Board of Examiners for the year to have been $583.10, of which amount $150.00 was paid by the Provincial Government, $218.00 paid by fees from candidates; leaving a balance of $215.10, which was paid by the Association

We are of the opinion that the expenditure of the Board should be kept within the sum collected as fees from candidates.

WILLIS CHIPMAN, }
H. B. PROUDFOOT, } *Auditors.*

27th February, 1894.

REPORT OF THE BOARD OF EXAMINERS.

During the past year the Board of Examiners held the two meetings as provided by Statute.

At the April meeting the following gentlemen presented themselves for examination, and passed in the order mentioned:

APRIL 1893.

Preliminary.

ELLSWORTH DOAN BOLTON.
JOCELYN JOHNSTON RICHARDSON.

Final.

H. J. BEATTY (not sworn in).

At this meeting the Board had under consideration for revision the list of subjects for examination, as set out in the Statutes, and the marks assigned to them, the results as finally adopted by Council being now printed in the by-laws.

At the November meeting the examination was conducted strictly as laid down and was found to work satisfactorily, with one exception, that is, the minimum marks for levelling appeared to be too high. The Board would therefore recommend that this be reduced from 40 to 35.

The following gentlemen presented themselves and passed in the order given:

NOVEMBER, 1893.

Preliminary.

JOHN ALEXANDER HEAMAN.

Final.

THOMAS ALEXANDER HARVEY.
MURDOCH JOHN McLENNAN.
MARSHALL WILLARD HOPKINS.
HERBERT JOHN BEATTY (sworn in).

On an inspection of the cost of examinations, it will be seen that the Association has had to pay a considerable sum out of its funds for this purpose over and above the fees collected from candidates and the grant given by the Government, which latter is now only $150. This is due to the following causes: 1. The fees payable by Statute to the examiners are "at least $6 per diem, and also travelling and hotel expenses." 2. The attendance of nearly all the Board is necessary, owing to the practice hitherto followed of having the papers marked as soon as written, which involves a large amount of work, and is more than one or two members could perform during the time.

The Board would suggest that some method be devised whereby the above difficulties may be overcome.

Respectfully submitted,

VILLIERS SANKEY,
Chairman Board of Examiners.

DISCUSSION ON THE REPORT OF THE COUNCIL OF MANAGEMENT.

Mr. Chipman—With respect to our exchanges, if you will refer to our published reports for 1887 and 1888 you will find that in those years we gave many more reports than we received. In 1886 we sent to the Michigan Society 200 reports and received only 75 in return; to the Ohio Society we sent 110, receiving 75; Indiana, we sent 110, receiving 75, and so for several years. I think if the attention of the Secretaries of these societies was called to this fact that they would certainly reciprocate now. Our Association has grown more rapidly than any of the others, and I do not see why they would not do so if it were pointed out to them, we should not be called upon to pay any such sum as $50 for these exchanges.

The Secretary—A suggestion was made in our report of last year, and as our membership was so very much in excess of that of any of the other Societies, and as all our members were entitled to copies alike, I asked for instructions as to what should be done with regard to the exchanges, and I was instructed by the Council to procure them if they could be had at all. In writing to the Secretaries of the different Societies I mentioned the fact that we required them, even if at an expense, and in five cases out of six they agreed to supply them on payment. The other society sent them free. Of course, as Mr. Chipman says, these exchanges have been unequal since the beginning, but on the other hand for several years past our membership has been somewhat in excess of the other societies though of course nothing like what it is now, and I think really the difference is rather too great to ask them to send such expensive publications as theirs are free. Of course whatever the instructions of the Association are to the Secretary he must carry them out, but I think we could scarcely expect all these extra exchanges for nothing.

Mr. Ross—I think these reports should be purchased at the present, or even at a greater cost. It is very interesting to have them and it is one of the benefits derived from belonging to the Association. I commend the Committee for expending the money, as it was necessary.

Mr. Sankey—They have simply charged us what they cost them and I think it is due to these Associations that this should be mentioned. They are not charging us fifty cents a copy as they would an outsider, but sixteen, or thirty-three cents as the case may be.

On motion of Mr. Ross, the Secretary was instructed to procure the copies necessary at a minimum cost.

Mr. Gibson—I believe one of the most important parts of that report is the instructions received by the Council from the Board of

Examiners. It seems it has been necessary to encroach upon the funds of the Association to defray the expenses of the Board. Well, whether it would be a matter of pride in the Association to keep up the payment of the members, or a matter of policy and good example, etc., is a matter for consideration. I think it may be that in first getting the Board of Examiners into working order, and perfecting the system which has been adopted, more expense has been incurred than will be necessary in future. Then I think in future we will have a larger number of candidates for examination and that would reduce the cost at once, and I am certain that the working of the system can be perfected and the expenses lessened after a little practice. Some of the members of the Board suggested that they themselves should reduce expenses by simply saying they would take less. Of course the statutory rule is that $6 a day is the lowest that can be charged, and in view of the previous fees, and the suggestion that the fees of the surveyor should be raised, they thought that that was the minimum that a member of the Board should take. Of course individuals who have never been on the Board can hardly realize the amount of work connected with it. If it was like one of the school examinations it would be a different thing, but this is a professional examination on a great variety of subjects ; and to really appreciate the labors of that Board you would have to experience them.

Now, one suggestion as to how to reduce the expense was that we have one examination a year, another suggestion was that we reduce the pay of the Board, and instead of $6 make it $4 or $5 a day and expenses, and another I think was that, a fewer number of members of the Board should attend, but the Board should be at liberty to pay those who do not attend for preparing and revising papers. I would rather have the members of the Board present. So that altogether it becomes quite a problem, and I would like to hear some of those present express their views on the matter.

The President—I think it is very praiseworthy indeed in the members of the Board to make propositions to reduce their own remuneration in the way they have.

Mr. Tyrrell—Was it stated to what extent it was necessary to draw on the funds of the Association?

The President—I think about $215 last year. It certainly seems to me that for the last year the expenses have been more than the Association can afford to pay, though you must remember that there were very few up for examination last year, so in future if there were more candidates the fees would amount to more.

Mr. Gibson—To examine one is just as great an expense as to examine half a dozen. So if half a dozen passed there would be a larger income and no greater outlay, but in future I don't think it will take nearly as much time, for we have got things into working order now.

Mr. Sankey—This is the first "snag," so to speak, we have run against in the carrying out of our new code of by-laws adopted under the authority of the Act. Probably many of the members are not aware that when we applied for legislation one of the things we asked to be allowed to do was to charge candidates at their final examination $50 apiece. Some of the members of the Government, in fact the Government themselves, objected to that ; they said it was an unreasonable charge, that it was too high. Previous to our obtaining incorporation the Government had to bear all the expense except what the fees covered, and some years I fancy it cost them a good deal more than they got, but in other years perhaps they made a little money. However, in order to get our bill through we had to consent to a reduction from $50 to $30, and unfortunately for us the Government have been also reducing their grant ; the first year we got $300, and this year it was $150. So that really it is not the failure of our Act, but we must make the two ends meet in the most advisable way.

Mr. Chipman--I may say that I for one am not in favor of reducing the fees to be paid to the examiners. I think $6 a day is little enough for that work. It does not represent the time they are at work here, it means a considerable time besides.

Mr. Butler—I support a reduction to $5 a day as a means of enabling the Association to swim clear. I don't think the Board of Examiners ought to sink the Association, and I think it carries with it a certain amount of honor which will compensate, perhaps, for a slight reduction in the earnings of the members.

Mr. Gaviller—I quite agree with Mr. Butler. We proposed that so as not to be such a strain on the Association.

Mr. Ross—I don't think we should begin by reducing the fees of the examiners. $6 a day is supposed to be the least anybody will work for, and we should not ask the examiners to work for less than the minimum tariff. I don't think we ought to entertain it at all, it is a bad precedent.

Mr. Hopkins—I also think it would be a bad precedent.

Mr. Coad—I think the honour is sufficient to make up for the dollar we knock off.

Mr. Chipman—I don't think it is the wish of the Association that the Board of Examiners should reduce their fees to less than the junior men that they turn out at their examination charge. I don't think it is right at all, and I think there are other means by which the cost of the examinations might be reduced materially, for instance by the reduction of the number of the examinations. One per year I think is quite sufficient for an association such as this is. Even if legislation is required to make the change, the cost of one examination will be much greater than the cost of preparing a bill to amend the Act.

Mr. Gibson—As to reducing the number of members attending the examination, I would desire to have, not less than four or five of the Board present. Three are not enough. The secretary is always as busy as he can be, and the papers have got to be prepared and gone into carefully. When a young man studies three years he wants fair play in every way. And I always like to have a representative from each section of the province ; there ought to be four at least.

On the motion of Mr. Chipman the question was referred back to the Council to report at the next annual meeting.

REPORT OF LAND SURVEYING COMMITTEE.

Mr. President,—Your Committee, in submitting their Report, wish to impress upon all members of the Association the importance of advising, without delay, the Executive of any proposed amendments to the Statutes under which we work.

Also, your Committee would suggest that the Secretary be instructed to send, in the month of September of each year, to all the members of the Association, a circular as follows :—

Give the names of all practising O. L. S. in the county in which you reside.

Give the names of all persons whom you know of who are practising surveying without license.

Name any municipal surveys in your county that have been confirmed by the Commissioner of Crown Lands during the present year.

Give any decisions, in cases of importance, that have been given at sittings of the High Court, relating to the Survey or Drainage Acts.

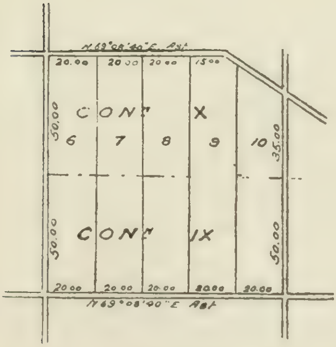
A number of questions, as to field work, have been submitted ; said questions, with decisions by your Committee, are annexed. We recommend all to aid heartily this important department.

All of which is respectfully submitted.

M. Gaviller,
Chairman.

QUESTION DRAWER.

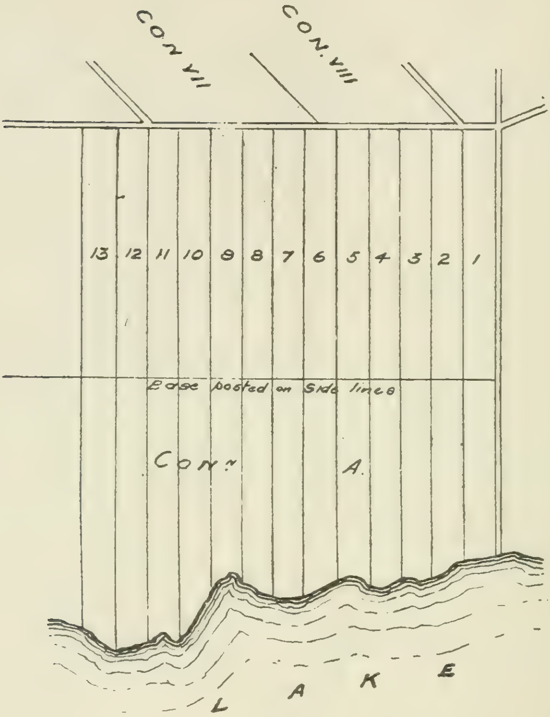
FIG. I



Question 1.—How would you establish the blind line across lots 9 and 10, between concessions IX. and X.?

Answer.—Divide proportionally.

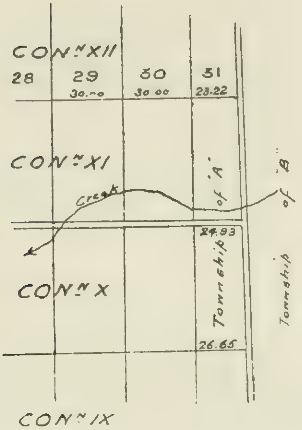
FIG. 2



Question 2.—The side lines of lots 1 to 13 are posted on the Concession Line, called in the notes "the rear of Con. A." The sides lines were also posted on a base, run parallel to the Con. line in the rear, as shown in the notes. No posts were planted on the lake front. The settlers have built to the posts on the base. How should the side lines be run?

Answer.—There is not sufficient data given. Apparently post on Rear Concession Line should be used.

FIG. 3.



Question 3.—In the annexed sketch: How would you fix the line, lots 30 and 31, Con. X.?

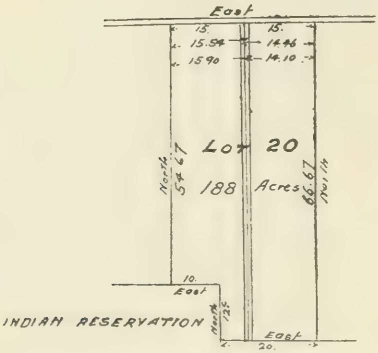
In the original survey, post was planted in Line Cons. X and XI. at Lots 28 and 29; and the surveyor continued:—" 1.70 links to a creek trend south-west, and large open marsh with deep water: so much so, that it is impossible to run this line any further through."

Thus it will be seen that in the original survey no posts were planted at Lot lines 29 and 30, or 30 and 31, or at the Town line.—The width of Lot 31, given on the sketch, is from the Plan.

By actual measurement on the ground the distance from creek to town line is about two chains short of Theoretical measure.

Answer.—Divide distance on ground from post, at 28 and 29 to town line proportionately to that intended in the original survey for the lots and proportionately at each lot line for the concession.

FIG. 4



A bought lot 20, containing 188 acres, and sold to B the east half, containing 100 acres more or less—no other description; and to C the west 95 acres—no other description. Required to run the dividing line.

Legal opinions No. 1—That the dividing line should be run from the middle point of front limit of lot, giving B 100 and C 88 acres.

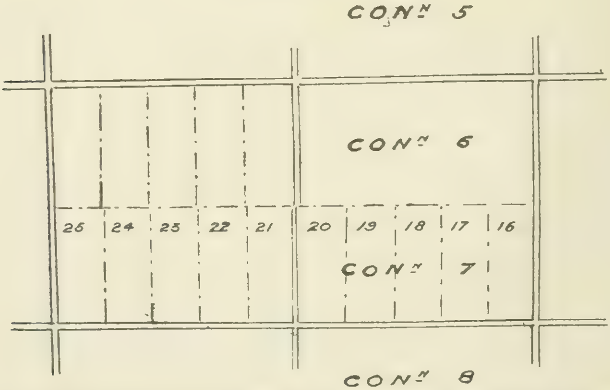
No. 2—That the dividing line should divide the 188 acres in proportion to the quantity mentioned in the respective deeds of conveyance to B and C which would give B 96-41 acres, and C 91-59 acres.

No. 3—That the dividing line should make an equal division of the lot, giving each of the parties 94 acres.

Question.—Which of the opinions is the correct one, or how shall I run the dividing line?

Answer.—Opinion No. 3 correct.

FIG. 5



On the side road between lots 20 and 21 Con. 6 and 7 in the Township of Egremont, in the original survey the side road is shown to be straight. Some years ago there was a dispute as to the location of the road between these lots near the line between Con. 6 and 7. and H. Wilson, P.L.S. was instructed by the Com. at the request of the Council and he located the side line with a jog of some 50 links.

Question.—How should the division lines between lots 21 and 25 be run. No posts were planted on the limit between Con. 6 and 7 on the side roads in the original. Wilson has set two stakes on the blind line.

Answer.—From all information given there should be no jog on the side road between lots 20 and 21. The lot lines should be run from the posts in front of the concessions to the depth of the concession and parallel to a line drawn between lots 20 and 21 across Cons. VI. VII., Sec. 55 and 56 Survey Act, 1887.

Tp. Chinguacousy was in original survey laid out at two different dates :

First survey, called " Front Half," or " South Half," seventeen lots in each Concession across the Tp. ; a side road at lot 15 and at every fifth lot ; also a side road at north boundary of lot No. 17, called " 17 Side Road."

Second survey, called the " Rear half," or " North half," consisting of fifteen lots in each concession, across the Tp ; northward from this " 17 Side Road " with a side road at lot No. 20 and at each fifth lot. The Tps. of Nassagaweya and Esquesing, immediately west, were, in the original surveyed in the same manner. Separate plans and field notes were returned of these south and north portions of these Tps. Original field notes of Tp. Esquesing show this Side Road 17 straight across the Tp. Original field notes of Tp. Nassagaweya show this Side Road separating " Front " and " Rear " halves. No original field notes of this Side Road in Tp. Chinguacousy can be found. All these original field notes and plans in C. L Dept. show this Side Road at 12 miles (or 32 lots, road allowance extra) northward from the rear of the second concession north of Dundas St , shewing it as intended for a straight line across the three Tps.

Question.—How should an obliterated portion of this 17 Side Road in the Tp. of Chinguacousy be established ?

Answer.—" Side Road 17," as stated, would be similar to a town line of a Township, and should be established as if intended in the original survey to be straight ; under Sec. 38 (Chap. 152) Survey Act.

REPORT OF COMMITTEE ON DRAINAGE.

To the President and Members of the Association of Ontario Land Surveyors.

GENTLEMEN,—Your Committee on Drainage beg leave to report that they have examined the two bills now before the Legislature, to amend the drainage laws of this Province as recommended by the late Drainage Commission.

And whereas said bills were sent out to councils, surveyors, public officers, etc., with a view to the expression of opinion thereon.

And whereas it is desirable that the opinion of this Association should be expressed thereon through the report of your Committee on Drainage.

Your Committee therefore suggest the following changes :

In " An Act respecting Ditches and Watercourses."

1. That Sec. 3 be amended to read " engineer " shall mean civil engineer or Ontario Land Surveyor.

2. That Sec. 5 be amended so as to read " every ditch constructed under this Act shall be limited in length to one-and-a-half miles."

3. That Sec. 11 be amended by striking out the word " five " and inserting instead the word " two."

4. That Sec 12 be amended by striking out all the words after the word " service " in line 34.

5. That Sec. 22 be amended by striking out the word " required " in line 18 and inserting instead the words " notified in writing."

6. That in Form " G " the Award of Engineer, it is neither necessary nor advisable to include an estimate of the cost of the materials required if any, and your Committee therefore recommend that the words " all of which, according to my estimate, will amount in value to $—," be struck out.

Your Committee also make the following suggestions in regard to " The Act to consolidate and amend the Drainage Laws :"

1. Sec. 3—It frequently happens that the " majority *in number* " of the owners in any described area to be drained represent only a very small part of said area although they control the whole drainage question in that area, in justice therefore to the minority who may own nine tenths of the land the following words should be inserted (on page 2, line 2), after the word city, viz., " or upon the petition of the persons owning at least two-thirds of the land within said described area."

2. That it is not advisable to bind down the Engineer to the method of stating the proportion of the cost of any work to be paid for " benefit," " outlet liability," and " injuring liability " and your Committee would recommend that the Bill be amended throughout to make this method optional with the Engineer.

3. Sec. 12—Your Committee recommend that this Section be struck out.

HERBERT J. BOWMAN,
Chairman.

Toronto, Feb. 28th, '94.

DISCUSSION ON PROPOSED CHANGES IN DRAINAGE LAWS.

(As to the change suggested with regard to the meaning of the word " Engineer.")

Mr. Gaviller—I heard it remarked when that proposed change was made that the object of wording it in that way was to cover the case of townships situated in a territory where surveyors were very scarce. It might be very difficult to get that clause amended in the shape in which it is put there, but the amendment might be worded in such a way that when a surveyor was living in the vicinity they should employ that man, and when it is impossible to get him, it could be put in such a shape that they could employ another person.

Mr. Gibson—How would you make out who a civil engineer is, a graduate?

Mr. Bowman—The courts would say.

Mr. Butler—It should say a civil engineer in some connection with the Canadian Society of Civil Engineers.

Mr. Sewell—But there are engineers who have no connection with the Society. Now, I am in connection with the English Institute, which I consider sufficient.

Mr. Bowman—It is simply to prevent townships employing some carpenter or handy man around the place when they can get an engineer.

Mr. Gibson—My impression is that the suggestion is very good if we could only get the matter in shape.

Mr. Gaviller—I entirely approve of it, but can we get it through?

(As to suggested amendment to Sec. 5.)

Mr. Bowman—We recommend that Section 5 be amended so as to read, "Every ditch constructed under this Act shall be limited in length to one and one half miles." It is "five lots" in the bill now, but that is very vague because there is nothing said about a road allowance. The ditch might go through two or three lots and run down the road allowance two or three miles, and the committee thought it would be better to limit the actual length of the ditch. In the report of the Drainage Commission a good deal of the evidence taken seemed to bear that out. One man gives that very opinion, W. Lounsborough, Cannington.

Mr. Gaviller—One and a half miles would cover a five lot block. The wording of the Act intends five lots straight ahead but it does not say so.

(As to the proposed amendment to Sec. 11.)

Mr. Bowman—We recommend that Sec. 11 be amended by striking out the word "five" and inserting instead the word "two." The committee thought five days was longer than was necessary, and it is only delaying matters, and often in the fall of the year it is a serious question.

Mr. Gaviller—I think that is looking to the postal service, to give time to communicate.

Mr. Bowman—They ought to be at the meeting. There is no time now at all, if they don't agree at the meeting any owner may go next day and ask the clerk to send a requisition. However, it is a trifling matter.

(As to the proposed amendment to Sec. 12.)

Mr. Bowman—We recommend that Section 12 be amended by striking out all the words after the word "service" in line 34. It appears that now the owner who serves these notices on the parties to come to the meeting has to endorse on the back of one of them the time and manner of service, and then he has to go away back to the engineer, who may be 20 miles away, and give that back to him again. Well, if the time is already fixed there seems very little use in that, he can endorse it on the back, and the committee thought it better to strike out all after "service." Instead of simplifying the Act that seemed to have complicated it. The idea was that this commission would recommend a change in the Act to simplify it, but they have done the very reverse.

(As to the proposed amendment to Sec. 22.)

Mr. Bowman—We recommend that Section 22 be amended by striking out the word "required" in line 18.

Mr. Gaviller—In the old Act notice in writing was required. Why should that be changed at all? A man might come to your place some day when you were not there and tell anybody about the place that he wanted the engineer to come.

Mr. Bowman—We recommend that they be notified in writing.

Mr. Gaviller—Certainly, and leave the old Act as it was.

(As to change in Form "G.")

Mr. Bowman—The committee recommend that the words "All of which, according to my estimate, will amount in value to $—," be struck out. There is no necessity for that clause; it is just complicating the matter.

Mr. Gibson—There is one point; supposing you should get a notice and in some way or other a mistake is made, is there any arrangement under this bill by which the surveyor can get his pay when he goes out?

Mr. Bowman—I don't think so.

Mr. Gaviller—The old Act says you are to levy the costs on the party.

The Chairman—I think it rests with the engineer to see that the formality has been complied with.

Mr. Wilkie—Is not the burden of that thrown on the Clerk of the Council? When the requisition is made to him and he passes it on to the engineer, does not the engineer go to work and it goes through all right.

Mr. Bowman—I think that must be the understanding, because that is probably why they inserted that requirement of bringing the endorsed copy of the notice back to the engineer. Up to the time the clerk sends you the requisition he is responsible for the formalities.

A Member.—It is the duty of the engineer to ascertain whether or not the proper proceedings have been taken. I understand there has been a decision to that effect, and I always take care to find out from all parties whether they have received the requisite notice.

The Chairman—It seems to me if the party who is beginning the whole proceedings neglects any part he is liable for the whole thing. In an action at common law he would be.

Mr. Gibson—I think something should be put in, that in the case of an irregularity on the part of the party applying, then the engineer shall be granted his expenses anyway.

The Chairman—I am afraid if you put in a thing like that it would look too much like class legislation, and the temperament of the times is against it.

Mr. Saunders—I have had cases brought to my notice in which the engineer could not make his award within the thirty days required by the statute. A man at the present time has filed a requisition to make an award in a case, and what are you to do at this season of the year ?

The Chairman—There is one maxim laid down in all laws that no man is required to do what is impossible.

(As to the Act to Consolidate the Drainage Laws.)

Mr. Bowman—We recommend that on page 2, line 2, the following words should be inserted after the word " city :" " or upon the petition of the persons holding at least two-thirds of the land within said described area." At present it goes entirely by numbers, a majority of the people living in the described area. There may be two parties who own about 500 acres with a number of small pieces around it of an acre or ten acres each, and the small owners really control the whole drainage question. They may want to obstruct it, they are not interested to any great extent for their one acre, yet they have as much to say as the other man with 500 acres. Now this alteration does not take away their rights of petitioning if they want the drain, it does not give the power to the larger land owners to block the thing, it simply makes it possible where the larger land owners want a drain for them to petition for it.

Mr. Tyrrell—I think that would be very advisable. I knew of a case where a drainage scheme was obstructed just in the way you suggest by some small owners.

(As to outlet liability and injuring liability).

Mr. Bowman—We recommend that it be amended throughout to make it optional with the engineer. Though engineers differ very little in results they differ a good deal in the methods of arriving at the result.

Mr. Gibson—I think the object of that is in case of a suit in court they can simply refer back to the engineer's report as to damage.

Mr. Ross—As regards outlet liability, it seems to be something similar to section 3, for injuring liability. Sections 3 and 4 refer to practically the same thing. There seems to be a fine shade of difference in the two, but it is very hard to get at. If you cause water to flow from any lands on to lower lands it would be apt to injure them, so that assessment for outlet should cover the whole thing. Sub-section 4 is almost similar, and if we had one section covering both and make no difference between injuring liability and outlet liability it would be better.

Mr. Coad—We have had a good deal of experience in our section where you very often have to lay out a drain in a low lying section of the country that has got water discharging from a higher part of the country. The high land has sufficient fall, so that they are not depending on the drain constructed in the low lying lands to carry off the water. The object is to make the engineer state where he draws the line between the lands that are directly benefited and where the water is caused to flow off more freely from the construction of the work, and where the liability comes in of the man from up stream as to water flowing down, and as to helping to carry it off. The man up country is liable to help to carry the water off the low-lying land, so that he is not assessed for direct benefit. My opinion always has been that what is asked for there in that Section to a certain extent is necessary, but they carry it too far and ask the engineer to state in dollars and cents how much this lot is assessed for liability and how much for benefit. That should not be the case, but the engineer should be compelled in his report to outline the manner in which his assessment is made. For instance, he may say all the lands lying within a certain district, mentioning the lands, are assessed entirely for benefit ; then another section is assessed for both liability and benefit—sometimes part of a lot is benefited and part liable. The report should outline roughly the engineer's views with regard to his assessment. I think if the report sets forth clearly what land he assesses for liability and what for benefit, that is all that a man ought to expect. Then if he wants to go into the question of the engineer's ability to assess the property he has a chance to go and do that in court. The Commission have got information out of a great deal of controversy that has come up before Judges and Referees and they have come to a conclusion, but I think it is too much to expect. The engineer ought to be a man reasonably up in his work, to assess the land properly, and he should outline his reasons for assessing it, but they should find out how many dollars and so on in another court.

Mr. Ross—I would ask whether Mr. Coad is in favor of dividing this into two—injuring assessment and outlet assessment ?

Mr. Coad—I don't see for the life of me why a man should say it is injuring liability. It strikes me a man is either directly benefited by water being caused to flow off that land or by the construction of that work he has obtained a better outlet. He is either directly benefited or else he is not. For instance, supposing before the drain is dug, a man has five feet of fall from his farm on to the next farm, then that man should not be assessed for direct benefit because he says I am independent of that drain. But then the man that owns the low lands has a right to say : you have no right to throw your water on top of my land. It seems to me injuring liability and assessment for indirect benefit are one and the same thing.

Mr. Chairman—Don't our statutes tend to set up that the low land owes servitude to the higher land ? Do you mean to set that aside and say that the high land has got to pay for the lower land ?

Mr. Coad—What the statutes want to get at is this, so long as the man up stream does not meddle at all with nature he is under no liability to the man below, but just as soon as he interferes with nature and causes a larger and quicker discharge of water on to his neighbour's property he is liable. But assessing a man for indirect benefit where he is assessed merely for liability and is not benefited by the construction of the work is one and the same thing.

The Chairman—I think perhaps it might mean that you strike a piece of low land and by doing so flood it and injure it, and you want to say how much you are going to allow for that injury.

Mr. Ross—No, you say how much the high land is going to pay for being relieved.

Mr. Gibson—In the paper I have prepared on roads I have taken up that matter of flood water. The English practice, as I understand the law, is this, that whatever falls directly above or springs from the land below may take its natural flow from the land in a state of nature, but if you collect that water on a roof or any other way and put it on your neighbour's land you have to take care of it. In the United States I understand you have a right to reasonable drainage, collecting your water and running it off in that way.

The Chairman—This section 5 uses the expression "injured lands." So that if you do not injure lands there is no injuring liability

Mr. Ross—Well any water brought from higher lands by any means would have a tendency to injure the lower lands, and why are you going to make a difference between outlet liability and injuring liability ?

The Chairman—If it flowed out and drowned the land it would be injuring liability, and if it merely interfered with the subsoil drainage it would be outlet liability.

Mr. Ross—There might be floods at one time that would drown the land and at other times would not. It would be pretty hard to make a difference between those two.

Mr. Coad—I cannot see that there is any difference between injuring liability and outlet liability, and assessing for indirect benefit, it is one and the same thing.

Mr. Bowman—(Reading a letter from Mr. H. Winter). Mr. Winter's idea seems to be that the municipality starting the proceeding should carry the work out right to the outlet instead of compelling the lower one either to take it up or be flooded out ; and thus to have it all under one control instead of divided.

Mr. Gaviller—In the old Act it says it must go to a proper outlet.

Mr. Bowman—The new Act says the upper one can get sufficient outlet and the lower one can take care of itself.

The Chairman—It seems to me the onus is on the engineer.

Mr. Ross—I think this Act provides for just going far enough to relieve the upper township, and then the lower township can go ahead and assess the upper township, but the engineer need not take into account the lower township. I think that is a good feature in this new Act. In the upper township perhaps there is a small area of land that they want to drain but to do that they might have to drain five times as much in the lower township and perhaps would not go on at all. Now you can only assess for benefit in the lower township and it is an injustice to the upper township, so I think this is a very good scheme.

Mr. Hopkins—It seems to me that there is some defect in the Act when there would be any injuring liability. As I understand that, it is allowable to run water down on somebody else's land, flooding it, and I don't see why they would have any right to do that at all, even if they did pay.

Mr. Bowman—They have got to go on the principle of the greatest benefit to the greatest number. It is almost impossible to carry out any work without making it disagreeable for some part of the country, and they try to benefit the largest area. The work is not necessarily a failure if in some parts the land is flooded.

Mr. Coad—I think the changes proposed in that respect are good. If it were not for those changes the up-lying township might carry out a very large work through the low-lying township and yet drain a very small portion of the township initiating the work.

Mr. Bowman—The Committee also recommend that Section 12 be struck out.

Mr. Hopkins—I think there are some good points about that A man has to know what he is doing ; he could not guess at his report then.

The Chairman—I think the Act will render it impossible for an incompetent man to do it all.

Mr. Bowman—It seems to be the opinion that to divide up the assessment into three heads will be rather an impossibility. Nine-tenths of the engineers do not seem to understand how, and a great many object to being required to do so. The Act now divides it into three columns, and our report is that that method be left optional. This is really the only point we suggest should be amended in the "Act to Consolidate and Amend the Drainage Laws."

The report of the Committee was then adopted.

QUESTION AND ANSWER.

The Tps. of A and B are both doing drainage work. The water flows from A through B and C to river for an outlet.

Township A requests Tp. B to dig their drain a certain depth at the town line between A and B, which causes B to have a much deeper drain than would otherwise be necessary ; also requiring the drain through B and C to be much wider to provide room for the flow of water as the drain in A is some miles in length.

Question.—How should the cost of the extra digging, etc., through B and C be assessed on the property in A Should it be assessed as the cost of the drain in A has been done, or in what way ?

Answer.—The engineer should make his assessment on A for outlet as he sees fit. He may be guided by the former assessment.

DISCUSSION.

Mr. Traynor—The drain runs up in A three or four miles. I made an assessment of the township of B, and it took a considerable depth of drain at the townline, starting at four feet six inches. For the drainage of B it was not necessary to have it anything like that depth to commence with. I assessed the extra cost of digging as a percentage on the engineer's assessment of A, and they are trying to hold that I had no right to assess anything unless a few lots immediately adjoining, that I had no right to follow it back for miles. My contention is that that was really a part of the cost of the drain, and that if his assessment was right the cost of the outlet should be assessed on all the property.

Mr. Coad—It seems to me there is no doubt the assessing of A would be right and proper, but whether that assessment should be in proportion to the assessment for the works done in A would be a different question. It would strike me that some of the adjacent lots next to the the townline in the township of A should be assessed for the work done in B a good deal higher than probably the man constructing the work in A for the simple reason that the drain without having an outlet would benefit the lots to a small extent next the townline in A whereas they might be benefited considerably farther up stream. I think the principle of assessing the township of A would be good, but not all the detail.

The Chairman—A shallow drain would have been sufficient for these lots adjoining the townline in A.

Mr. Traynor—I might state that some of the lots adjacent to the townline were not assessed in the drainage system by the engineer of A. They were not included in that portion of his assessment that formed a portion of my assessment.

Mr. Coad—That would carry out exactly the principle that I wished to explain. You would be assessing them under that section of the Act where they propose to divide it up into several parts, and so you assess a man for outlet, and you assess him for indirect benefit, and for injury and so on.

Mr. Traynor—I fail to see why you would assess him for injury in that case, because I don't believe it would be much injury to him.

Mr. Coad—The township of A is liable to pay money to do away with the injury. The work that you would construct in the township of B would be for the purpose of taking away an injury that existed. That injury would be caused no doubt a great deal by the township of A, and in paying for the removal of that injury they would be paying their liability which they want to describe in the new Act as assessing them for injury caused by their waters coming down on the lower township. The great trouble seems to be the name you give, whether it is for outlet, or injury, or indirect benefit, or whatever you like.

Mr. Burke—I would be inclined to assess those lots adjoining the townline there, higher than I would assess all the way up for extra digging. I don't know whether I would be right or not, but I think that is the way I would do it. That is for outlet.

Mr. Bowman—From what the committee members here have said I think that the engineer on B should make his assessment and be guided in some way by the assessment that the engineer of A made, but need not necessarily follow it entirely. It seems only right that the lots down at the townline should pay more than those at the extreme end of the township. He would have to make an entirely separate assessment.

Mr. Traynor—I made an entirely separate assessment, but their contention was that I had no right to assess any but a few lots right at the townline.

Mr. Bowman—If they bring some water here through the construction of this drain they have got to pay for part of this drain. If they want a greater depth than nature has afforded they have got to pay for that greater depth, and if they bring a greater volume of water they have got to pay for the extra size of this drain to take that volume of water away. This extra depth here at the townline benefits those away at the upper end.

REPORT OF THE COMMITTEE ON TOPOGRAPHICAL SURVEYING.

Mr. President,—At the last annual meeting it was resolved to appoint a Standing Committee on Topographical Surveying. In due time the members of this Committee were notified of their appointment but no instructions were issued to us by the Council or by the Association.

The Chairman of this Committee sent a circular to each member requesting replies to the following questions:

1. Under what authority or authorities should the work be proceeded with ?
2. (*a*) What would be the cost of the primary triangulation, (*b*) secondary triangulation and (*c*) the Topographical work ?
3. How is the cost to be defrayed ?
4. What financial benefits will the settled parts of the Province derive from such a survey ?
5. Can you give conclusive arguments why our Government should proceed with the work ?

From the replies received, it is evident that more time is required before deciding upon a definite line of action.

The memorandum on a trigonometrical survey of the Dominion, prepared by a Special Committee of the D.L.S. Association in 1888, and printed in the Report of the Association for that year should be read carefully by every member of this Association. This carefully prepared memorandum represents a great amount of labor by the Committee, and to them must be given the credit of taking the first steps towards bringing this important matter to the attention of the Government.

Members of Special Committee:—Otto J. Klotz, D.T.S., W. F. King, D.T.S., W. S. Drewry, DL S., E. J. Rainboth, D.L.S , J S. Dennis, D.T.S.

For a few years, the work of our Committee must be of a missionary character. The members of the profession must first of all divest themselves of the idea that when this work proceeds a great number of O. L. S's. will be employed. Patriotism and professional pride must be our only motives in urging on this necessary work.

We must discuss the problem among ourselves and when we become somewhat well posted, we may venture to broach the subject to others. The following questions will at once suggest themselves:

1. Is the work necessary?
2. What will it cost?
3. Will it pay?
4. How is the cost to be defrayed?

Every member of this Association must have logical answers to all of these questions before we can expect our Legislators to pay any attention to a Topographical Survey.

A paper on "Topographical Surveys" prepared for the International Engineering Congress of the Columbian Exposition, 1893, by Herbert G. Ogden, Assistant U. S. Coast and Geodetic Survey, gives the cost of different surveys as follows:

SURVEY	COST PER SQ. MILE.	SCALE	REMARKS
France	$186	1:50,000	Ordnance Survey,
Great Britain	244	1:25,000	" "
Germany	79	1:25,000	
Austria	400	1:25,000	All expenses
Holland	16½	1:25,000	Revision only.
India	11	1: equal 1 mile.	
"	26	2: " "	
"	400	6: " "	
Massachusetts	13	1:30,000	Geological Survey.
Connecticut	9.80	1:30,000	" "
Rhode Island	9.00	1:30,000	" "

In New Jersey the cost was about $7.00 per square mile.

We believe it to be the duty of this Association to act as an Advisory Board to the Department of Crown Lands and to bring to the the notice of this department any improvements that we may consider necessary respecting methods of survey, or to recommend to the Department any change in policy that will tend to keep our professional work abreast with that being done by other civilized nations. We also believe that our Legislature will welcome any assistance we can offer, but we must first become a united body, and be able to present our request to the Legislature so intelligently, so forcibly and so justly that they cannot do otherwise than comply." (Page 20, 1886, Report of Provisional Executive Committee on Incorporation. Our Bill of Incorporation was passed April 1892, thus representing a labor of six years.)

This Province has been expending annually about $40,000 in Crown Surveys for a great number of years. Generally this money has been spent economically, and if it has not all been spent wisely, the members of this Association and therefore the Association itself, must assume the responsibility to a considerable extent.

Would it not be better to spend half of this sum on a Topographic Survey of the older portions of this Province ? We think it would. At $20 per square mile, this would represent a completed survey of 1000 square miles per year an area approximately equal to the County of York, the County of Lambton or the County of Carleton. We are of opinion that the following is an outline of how the work should be proceeded with :

(*a.*)—The International boundary lines, the coast lines and the primary triangles to be surveyed by the Dominion Government and permanent marks left of the work done.

(*b.*)—The Provincial Government to proceed with the Secondary Triangulations and the Topographic work.

(*c.*)—Plans to be drawn on a scale of 1.25,000 and contours shown at every 20 feet of elevaion.

(*d.*)—The cost of the Provincial work must be kept below $20 per square mile, and the total yearly provincial expenditure should not exceed $20,000.

WILLIS CHIPMAN,
Chairman.
JOS. COZENS.
A L. RUSSELL.

DISCUSSION.

Mr. Chipman—I might add that some of the views expressed here are somewhat radical, and we must approach this subject in a very careful way, but I don't think it is a more difficult problem than that of incorporation, which has been so successfully consummated. That was looked upon as something beyond our reach altogether a few years ago ; in fact when this Association was organized it was looked upon as rather a precarious undertaking, but we have succeeded, and I think we can succeed with this other matter if we approach it in the right way and become perfectly *au fait* in the matter ourselves before we go to the Legislature.

Mr. Gibson—There is no question in the world about a Topographical survey being a good thing. In the United States, where they call it their Coast survey, it is of the utmost importance The Dominion wants the same thing, but how are you going to get it ? It is a good thing to be hoped for and prayed for and talked about. It would be a move in the right direction.

The President—I would like to ask Mr. Chipman, if in preparing the report, they considered how the surveys were done in the United States. I was not aware until recently that a triangulation survey had been continued right across from the Atlantic to the Pacific. I was at the World's Fair, and they had a globe there nearly as large as this room, showing all the triangles from the Atlantic to the Pacific, and all the principal base lines, where they were chained, were set in brass Was the Coast and Goedetic survey taken up by the individual States or by the United States Government ?

Mr. Chipman—I think the Coast survey was done by the Federal Government, but the filling in of the triangles and other work was done by the States afterwards. In New Jersey it was done by the Geological Survey Department. In New York it was done by special survey.

The whole point is just this: Our Provincial Government is spending $40,000 a year on surveys; wouid it not be better to spend half of that on a Topographical survey rather than spend so much in Algoma ?

Mr. Gibson—Suppose we sent you as a deputation up to them how would you put the matter so that they would see the advantage of it?

Mr. Chipman—The best evidence we have is given in that little report of the Dominion Land Surveyors' Association of 1888.

The President—In some of the American publications there is a report, that in Massachusetts State if there had been a Topographical survey made in early times, it would have saved fabulous sums in the way of locating railways. If we had one when a line of railway was proposed they could just refer to it and see how it would be, and the same with drainage works.

Mr. Chipman—Such surveys would be useful in every class of engineering work. We would need no preliminary surveys at all. In England there is no such thing as preliminary survey.

The President—I thought perhaps you had the idea of the Province following up and filling in, as it were, the work of the Federal Government. I think perhaps you will find that the United States have done that.

Mr. Chipman—They have done that generally.

The President—Are you aware why the Dominion Government gave up the Triangulation survey in the North-West? They followed it up to Fort Pelly and then left it off.

REPORT OF PUBLICATION COMMITTEE.

Mr. President,—Your Committee have to report as follows :

The "Proceedings" for 1893 were printed by C. Blackett Robinson, as usual.

Our exchanges are as follows :

EXCHANGE LIST.

	SENT.	RECEIVED.
Michigan Engineering Society, F. Hodgman, Sec., Climax, Mich	140	195
Iowa Engineers and Surveyors Society, Seth Dean, Sec. and Treas., Glenwood, Iowa	55	195
Indiana Engineering Society, W. P. Carmichael, Cor. Sec. Williamsport, Ind	130	195
School of Science Engineering Society, Jos. Keele, Cor. Sec.	150	194
Ohio Society of Surveyors and Civil Engineers, Chas. C. A. Hudson, Sec. and Treas., Sandusky, Ohio	130	195
Illinois Society of Engineers and Surveyors, S. A. Bullard, Ex. Sec., Springfield, Ill	110	134
Association of D. L. Surveyors, J. I. Dufresne, Sec-Treas., Ottawa	10	10

A copy has also been sent to each of the following :

Public Library, Toronto, J. Bain, Jr., Librarian.

Cornell University, Ithaca, N. Y., Prof E. A. Fuertes, Director, college C. E.

Mass. Inst. of Technology, Boston, Mass., Clement W. Andrews, Librarian

Engineers' Society of Western Penn., 5th street, Pittsburg, R. N. Clark, Secretary.

Professor Carpmael, Toronto Observatory.

"The Surveyor," 24 Bride Lane, Fleet Street, London, E. C., England.

John W. Suggett. Sec. Local Board State Normal and Training School, Cortland, Cortland Co., N.Y.

Your Committee would like to draw the attention of the Association to the amount received for advertisements, and point out that it goes a long way towards paying for publishing the Report. They hope the profession will continue to patronize those advertising with us, and give any assistance in their power to getting new advertisements.

Your Committee would also like to call the attention of those reading papers to their report of last year with reference to plans and diagrams attached to papers.

Respectfully submitted,

H. L. Esten,
Chairman.

REPORT OF COMMITTEE ON ENTERTAINMENT.

Mr. President,—The Entertainment Committee for 1893-4 beg to report as follows :

The place of meeting of the Association having given general satisfaction, the same rooms in the Canadian Institute were engaged for this year's convention, and upon the same terms.

As the usual form of entertainment, the annual dinner, had been decided upon at a meeting of Toronto members of the Association, arrangements were made with Mr. H. Webb for that purpose, and on the evening of the 28th February it took plaçe at his apartments on Yonge street.

The only invited guests able to be present were Mr. Aubrey White, Assistant Commissioner of Crown Lands, and Mr. A J. McPherson, representing the Engineering Society of the School of Practical Science.

Letters were received from the other invited guests, Hon. A. S. Hardy, Commissioner of Crown Lands, Professor C. Carpmael of the Toronto Observatory, and Mr. E. H. Keating, C E, City Engineer of Toronto, regretting their inability to attend and expressing good wishes for the enjoyment of all.

The members present consisted of yourself as Chairman, Mr. M. Butler, as Vice-Chairman, and Messrs. Niven, Chipman, Kirkpatrick, Galbraith, Sankey, VanNostrand, Lumsden, Abrey, Bowman, Tyrrell, Evans, Ross, Jones, Speight, Walker, McKay, Wilkie, Miles, Proudfoot, McMullen, Ellis, Esten, Hopkins, Traynor, Burke, Sewell, Hutcheon, Whitson, Foster, making with the two guests present thirty-three in all.

After due appreciation was shown for the excellent menu provided by our host, the usual toasts were in order, proposed by yourself, the Vice-Chairman and others.

"The Queen" was drunk by all and "God Save the Queen" sung with the usual fervency characteristic of our members, after which followed "The Ontario Legislature" responded to by Mr. Niven and Mr. White; "Sister Societies" by Messrs. McPherson, Galbraith, Lumsden, and Butler; "The Militia of Canada," by Messrs. Jones and Sankey; "The Mining Interests of Canada," by J. D. Evans; "The Association of O. L. Surveyors," proposed by Mr. Galbraith, responded to by yourself and Mr. Kirkpatrick; The "Father of the Association," proposed by Mr. Niven, was responded to by Mr. Chipman; "The Entertainment Committee" proposed by Mr. White, was responded to by Messrs. Foster, Ellis and Speight; The "Geological Survey" was responded to by Messrs. Galbraith and Tyrrell; "The Secretary," by Mr. VanNostrand; "The Ladies," proposed by Mr. Butler and responded to by Messrs. Hopkins and McMullen.

Between these toasts several songs were sung by Messrs. Niven, Foster and Sewell and a recitation by Mr. T. H. Jones, giving a pleasing variety to the entertainment, after which "Auld Lang Syne" was sung and an adjournment was made to the ante rooms where social conversation was continued till a late hour.

A detailed account will be deposited with the Secretary of the Association showing the receipts and expenditures of the Committee.

All of which is respectfully submitted.

On behalf of the Committee,

FRED. L FOSTER,

Chairman.

NEW BUSINESS.

RE REPRESENTATIVES FROM OTHER SOCIETIES.

Mr. Chipman—Has there ever been any move made towards getting representatives from the other societies to be in attendance at our meeting.

The President—I took the liberty of writing to the Secretary a short time ago suggesting something in the line of my address last year, that it would be advisable perhaps to communicate with the different Associations with whom we exchange proceedings, inviting them to send a representative to our meetings, who would also be a guest at our dinner.

The Secretary—In accordance with the suggestion of the President I wrote to the Secretaries of all our exchange societies inviting them to send representatives for the annual meeting and dinner, and we received two replies, from Ohio and Michigan I think. I received letters to-day stating that they had delayed replying in the hope of getting someone who would be able to attend, but they finally found that they had no one who could leave his business for such a length of time The School of Practical Science here, however, has been represented during the whole meeting, and also at the dinner last evening.

RE BIOGRAPHICAL SKETCHES.

Mr. Chipman—There is another matter which has suggested itself to me, that is the compilation of biographical sketches of the early surveyors of this country. We are making an attempt at it year by year, but I think an organized effort should be made. We should ask each of the older members of the Association to send in a short sketch of his own professional career and also of those to whom he was apprenticed or articled. These older members probably served their time with some other surveyor whose name appears upon the list of surveyors in the Crown Lands Department. I know in the east there are several men now practising who remember the preceding surveyors whose works are now practically forgotten, we only know them by seeing their names on the list. I think an effort could be made, and should be made, to communicate with these older members by circular and to mention the names of the surveyors of whom we wish them to write a biographical sketch. It would become an interesting feature in our reports.

Mr. Sankey—We have received a letter from Mr. Sherman Malcolm, one of the very oldest members of our Association, which would very properly form the preface of the subject Mr. Chipman has just referred to. He says he has been connected with the practice of surveying for thirty or forty years and gives an interesting history of the surveyors in his locality. He mentions a number of names and refers to the time when there were not enough surveyors in the country to do the work and the Government had to appoint deputy provincial land surveyors to perform services in various parts of the Province. We have the preface at any rate of what Mr. Chipman asks us to do, and I certainly quite agree with what he says. It would be a most interesting feature of our report if we can get such information. I think within the next year or so we might get a great deal of material in that line, which after that time would be lost altogether. I agree with Mr. Chipman that something definite should be done. We cannot ask our Secretary to hunt up this ancient history for us because he has enough modern history to attend to. I think a committee should be appointed for that purpose.

A Committee was then appointed in accordance with Mr. Sankey's suggestion.

RE POLAR EXPEDITION.

Mr Chipman—This scheme may prove not so impracticable as might be supposed at present. It is quite possible I think to organize an expedition ; it is just a question of dollars and cents. Many of those whom I have named on the Committee have had experience in our northern country and they know what the hardships are, and I believe that the hardships farther north are not in proportion to the latitude, and that they will find no greater difficulties north of the Arctic Circle than immediately south of it, perhaps they may be lessened. The land scheme is in my mind, from what I have read, more practicable than depending on boats and vessels. I believe, if we could induce the government of this or some other country to assist in some way to raise the money to pay for such an expedition, and for commencing a regular survey, that there are members of this Association who are so wedded to the profession that they would brave all the hardships ; follow the line of collimation of their transits and be at the North Pole perhaps before they realized it.

DISCUSSION AS TO THE PETITION RE REDUCTION OF DUTY ON SURVEYING INSTRUMENTS.

The President—I think perhaps it would be in order for the Association to express their views regarding the memorial from the Provincial Land Surveyors' Association of Manitoba. They have sent us a copy of the petition they sent to Ottawa, asking that the duty be reduced on surveying instruments ; and I have a letter here from the Secretary. The memorial is as follows :—

MEMORIAL OF THE PROVINCIAL LAND SURVEYORS' ASSOCIATION OF MANITOBA.

To the Honorable the Minister of Finance, Ottawa :

Your Memorialists would respectfully show that they are an Incorporated Body having a membership of nineteen members in good standing.

The work of Land Surveying necessarily involves the ownership by each Surveyor of about one thousand dollars in Instruments for the purpose of surveying—field and office work—composed chiefly of transits, theodolites, levels, compasses, sextants, field glasses, telescopes, levelling-rods, chains, tapes, draughting instruments, and material, including drawing paper, tracing linen, cross section paper and blue process paper.

The tariff upon these articles ranges from 25 per cent. to 35 per cent. ad valorem. The work required from a surveyor is necessarily one of the greatest precision, on account of the very important interests to private and public rights which are involved ; and every surveyor in order to do justice to the public and to his profession must procure the most modern and complete instruments of the several kinds wherever manufactured.

The manufacture of surveyors' instruments is not carried on as a business by any person or firm in Canada, and we respectfully submit that to produce successfully the higher class of instruments required for our profession would necessitate a very much larger market than is at all likely to be afforded in Canada for many years to come.

Your Memorialists would point out that the tariff in this way bears unduly upon them and would respectfully submit that in the reconsideration of the list of dutiable goods the instruments and material required by Surveyors should be placed on either the free list or under a schedule at a much lower ad valorem duty than is now charged on such goods.

Your Memorialists will ever pray.

(Signed) R. E. YOUNG,
President.
J. W. HARRIS,
Secretary.

WINNIPEG, NOV. 1, 1893.

Mr. Sankey—What we did was this : It seemed to be necessary to take some action before our annual meeting, and we sent a copy of the petition to each member of the Council, asking his opinion thereon. The answers we received were unanimous, so we sent a letter to the Minister of Finance, saying that we had received this Memorial, and that the Council was unanimous in asking that it should receive due consideration ; and that it would be brought up before the Association of Ontario Surveyors at the next annual meeting. We also informed him that we had about 200 members in good standing, and about 33 members who had retired from practice. I proposed to bring this matter before you, and to suggest that we might also prepare a memorial and send it down, and, also, that we might request the Association of Quebec, British Columbia and other provinces to join us. I think it would perhaps be advisable, also, to bring it before the Engineers' Society ; they are equally interested in these matters with us. If that were done, there is no doubt it would ensure this memorial receiving more consideration than if it merely went from Manitoba alone, or from Ontario alone. I think we should do something to help each other in that way. I therefore move that the

Secretary be instructed to forward a memorial to the Minister of Finance, in Ottawa, on the same lines as the one presented by the Manitoba Association; and, also, that the co-operation of other Surveyors' Associations in Canada, and the Society of Civil Engineers be asked.

Mr. Niven seconded the motion, and it was carried.

RE EMPLOYMENT OF UNLICENSED SURVEYORS.

Mr. Gaviller—There is a subject mentioned by Mr. Bowman to-day which I think might be discussed here, namely, that in some county in the west, he did not mention which, they are in the habit of employing what they call a road engineer. When a township council requires a deviation in a road or anything of that kind the road engineer goes to work, measures this road up, locates it and stakes it all out, makes a description of it by metes and bounds, and this description is put in the deed and the road is established by by-law, no licensed surveyor being consulted on the subject whatever. I should think this is a pretty plain case for the Act to be put in force.

Mr. Wilkie—The same thing is done down in our part of the country, the County of Lanark. Each township employs some farmer usually as a road surveyor, and he lays out the road and describes it after his fashion, after which a by-law is passed, and it is all fixed up in that way. However, these men don't seem to get along very well, and although they go out and practise surveying among the farmers, charging them about $1 a day for their services, as a rule I find that the farmers object to their work, there is generally something wrong, and they call me, or somebody else in, to establish it for them. So that as a general thing, down there I think instead of doing harm, they perhaps do us good, because we get more work. I was called on once last winter to correct an error one of these men had made of ten chains in three lots.

Mr. Tyrrell—I have some doubts of these outside practitioners doing us any good. I know in the County of Wentworth I could name half a dozen farmers and men through the county who do surveying habitually. They form a sort of intermediate step between the farmer and the surveyor. They are paid, I think, usually about $2 a day, and they do a great deal of work that surveyors should be called upon to do. I really think the Association ought to attend to them. Only last week up west of Hamilton, I was informed of a survey that had been made by a farmer, for a neighbor of the man I was working for, and I have met with that kind of thing constantly.

Mr. Sankey—As chairman of the council I am very glad to have heard these remarks. One of the benefits that we held out to surveyors who were not in our Association before incorporation was, that this sort of thing would come under the control of a responsible body, and that it would save the individual surveyor the personal trouble or onus, if I may put it that way, of prosecuting the unlicensed practitioner. Up to the present we have not had any very definite charges in matters of this kind brought before us. There is one, but it seems to me one of the difficulties we will have,if we proceed with the prosecution is to prove the receiving of pay for the work done. As I understand it, the payment made in the case to which I am now referring was in the shape of work in connection with the survey. Certainly I was not aware that the evil was so wide spread as it appears to be, and if the surveyors of this Association find that their rights are being encroached upon, I am sure that this council will be only too glad to get any sort of authentic information on the subject. Of course we must get definite information that the survey was made, and, secondly, that it was paid for.

Mr. Gaviller—Acting as a Provincial Land Surveyor would not necessitate the actual payment of money for services.

Mr. Sankey—The difficulty is this : I presume a man, if he could chain correctly or run a line on proper bearing, and did it for his brother or uncle or cousin and did not charge for it, it might be a difficult matter for us to prosecute him before the courts and succeed, and if we cannot insure success, the Council is of the opinion that it is not advisable to just make a dash at a man, and then draw back because we have not got sufficient evidence. But certainly the desire of the present council is, that in the first case, in which we have a reasonable chance of convicting, to prosecute, in order to make an example of such practitioners. I think we are bound to do it from the representations that we made before incorporation, and I think it is in the interests of the Association and this profession at large that we should do so. We should make these unlicensed practitioners feel that our Association is something, that it is not merely for the interchange of ideas or intellectual talk, but it is for some real, reasonable purpose, and I don't think there is anything more reasonable than protecting the public and our own interests.

Mr. Chipman—I am somewhat surprised to hear that this disease has spread to the western part of the province. It has been quite prevalent in the east, but along the border counties it is pretty well stamped out. While I was secretary of the Association, there came to my notice the fact that a township clerk in the vicinity of where I was practising, was laying out and sub-dividing land, etc., so I wrote him a letter, and we were very shortly afterwards appointed township engineers, and called upon to do the work that this gentleman had been doing previously. He was working ignorantly, and was not aware of this provision in the Act. We must not assume that these gentlemen are wilfully encroaching upon our field of operations or labor, because if you consult the proceedings of Board of Quarter Sessions of the old district of Johnstown, they met quarterly in that district, and invariably appointed some one as road surveyor and this gentleman laid out the roads. Nearly all of the forced roads were laid out in that way, and the descriptions as printed in the proceedings are exactly on a par with what we read from that letter. The courses in the earlier ones, instead of running to stakes, ran to beech trees and elm trees, etc., and the bearings were all wrong. The distances may have been wrong, or they may not, but in retracing these old roads it is practically impossible to see where they were laid out. I believe if the Council through their secretary would send to each party charged with doing this kind of work a very stiff, strong letter, written with a typewriter, and in a large envelope sealed with a good quantity of wax, that man would soon stop his operations.

Mr. Gaviller—I am very glad to hear that our late secretary has had an experience of that kind and that he was successful in being appointed township engineer. No doubt he was astonished, but I was astonished myself when I acted in the very same manner. I generally carry a copy of the Act with me, and I found out on one occasion in which I was sent for, that there was a bush ranger out ahead of me and he had actually been to the place, but when I quoted the Act, the bush ranger retired from the scene. I know he has never done any more work in that township, and I have been appointed township engineer myself.

Mr. Sankey—With regard to the suggestions made, I may say that if the members of the Association will give the Council any clue, we will pay for the wax and envelope.

PAPERS SUGGESTED FOR NEXT MEETING.

Mr. Gibson—It is a perfect burden to our Secretary to select individuals to prepare papers for the meetings, so I suggested to him that if he would mention the matter at the meeting of the Association probably we would have enough subjects suggested to last two or three years. Some are of the opinion that if a paper is a little outside of the surveying line it is not the thing, but I say whatever a land surveyor is engaged in let him tell it.

Mr. Chipman—I would like to hear a paper upon the boundary line between Ontario and Quebec. I don't know whether any of the present members of the Association were on that work or not.

Mr. Niven—I don't think so; it was run by Mr. O'Hanley on the part of Ontario and Mr. O'Dowd on behalf of Quebec. It was run about 30 odd miles from the head of Lake Temiscamingue and there it stops.

Mr. Gibson—I would suggest that Mr. Niven prepare the paper. He has been in that section of the country and I am sure he would prepare a very interesting paper.

Mr. Burke—It would be very interesting if we could get a paper on the Alaska boundary. Perhaps Mr. Klotz or Mr. Ogilvie will give that.

Mr. Sewell—Mr. Proudfoot and Mr. Whitson have been down Rainy River a good deal; they might tell us something about that part of the country.

Mr. Gibson—The Separate System of Sewerage, by Mr. Chipman, I think would be a good thing.

The Chairman—(Mr. Butler)—It struck me that a paper on our standards of measurement as governed by the Dominion and Provincial Acts should be dealt with. I think I spoke of it last year. Every surveyor or every other man using a measure of length is bound to submit it to the Department of Inland Revenue or be subject to a fine. It seems to me it really requires the action of the Association to draw the attention of the Department of Inland Revenue to the fact that they have no facilities whatever for making the test, and to suggest that the Act be changed in such a way that we can submit our measurements to a standard. At McGill College they have facilities for testing with the utmost precision.

Mr. Gaviller—That question came up before, and it was mentioned that there was a standard measure then under construction at the School of Practical Science. It is marked on stone and brick piers, 100 feet.

Mr. Niven—It was suggested in the discussion of this, last year, that we should get our standards from Ottawa. Mr. Dickson sent for one and before going out I took the precaution to test my chain by that one, and I found that the steel band that I purchased at Rice Lewis' was exactly correct. I may say also that I used a steel band for five years without testing it, and then when I tested it by a new one there was scarcely a hair's breadth of difference, it was simply due to the ends of the handles being worn. I think the standards at Ottawa answer every purpose and they can be got for $8 each.

Mr. McAree—Is there not some difference between the Dominion and Ontario Standard ? I heard of a survey made in the north-west, and there was something like a difference of a link in a mile !

Mr. Butler—Has the Ontario Legislature jurisdiction over measures ? I don't think they have ; it is entirely within the powers of the Dominion Parliament to legislate in regard to that, and consequently we are in that sense subject to the Dominion.

Mr. Gibson—I think Mr. Kirkpatrick or Mr. Abrey should prepare a paper on that.

Mr. Butler—I would suggest that the metric system be outlined in connection with it at the same time. That is a reform more pressing and needy than any other.

Mr. Chipman—I would like to ask some member of the Board of Examiners to explain fully to the Association how members as they are graduated, and how surveyors are to test their band chains by means of the pine rods that are given to them ?

Mr. McAree—I would ask by what authority these rods are issued at all.

Mr. Burke—Do you think that these band chains are much affected by the temperature ? I was talking to Mr. Young of Winnipeg about it, and he has a chain made in the States, part of it is of aluminium, and it is very narrow. He has made measurements with it both in summer and winter, and he is making them this winter, he says the difference in these measurements is almost imperceptible. He does not think that the difference in temperature is worth noticing at all.

Mr. Butler—When you come to geodetic measurements the elasticity of the material in the tape is a factor as well as temperature, and also the strain upon the tape.

Mr. Hopkins—When I was engaged at steel bridges we had to punch long plates 30 feet long, and in marking for these punches we never used a wooden measure because wood would not expand and the metal would. We always measured them with a steel tape so that each would expand in the same proportion. If you take a long steel bridge and mark out these rivet holes with wood, and the temperature varies from day to day, when you come to erect your bridge you will find that the rivet holes that ought to come right opposite one another do not concur.

Mr. Gibson—I have constructed a steel bridge 356 feet long and used a steel tape all the way and it turned out splendidly; every thing fitted, vertically, longitudinally, and every other way.

Mr. Smith—Somebody here has asked, "How would a person living in the country get this standard of measurement, if there be such?" That is the difficulty. It is a theoretical one, it is not a practical one at all to my mind, because everyone can get a Chesterman tape or a steel tape, and I have measured bridges hundreds of feet long, laid them out with a steel tape, and there was no practical difficulty at all. The question in my mind is, where can we reach that position where we can get a practical solution of the difficulty? What shall be the length and where shall we get it? To lay down any standard in any particular place to my mind is impracticable. You might as well lay it down in London, England, as in Ottawa or in Toronto for a great many people. Everybody knows that a Chesterman tape, or a steel tape, I don't care who is the manufacturer, is very much better than these short measures however accurate they may be. I think that some standard might be suggested at any rate by this Board, a certain tape of 66 to 100 feet in length wherever procurable; and when it could be established that a surveyor tested his tape, or whatever he is using, by this standard, it ought to be accepted as legal evidence that he used an accurate measure.

Mr. Chipman—I think the best thing we can do is to appoint a committee to bring in a report next year. For my part I think these iron-link chains should be abolished.

A committee was then appointed in accordance with Mr. Chipman's suggestion.

PRESIDENT'S ADDRESS.

GENTLEMEN OF THE ASSOCIATION OF ONTARIO LAND SURVEYORS:

I have much pleasure in welcoming you to this our Second Annual Meeting as a corporate body, and the ninth as an Association of Land Surveyors of this Province.

Since our last meeting we have lost by the hand of death, probably the oldest member of our Association, namely, Mr. Thos. Fraser Gibbs, of Adolphustown, who died in April last, in his 82nd year: an obituary notice of which was inserted in our report of last year. Mr. Gibbs stood in the front rank of the profession, and was for many years a member of the Board of Examiners. He heartily approved of the recent changes in our status as a body, as expressed in a letter which he wrote to the Secretary about two months before his death, and in which he regretted being unable through age to attend our last Annual Meeting. I think I can scarcely wish for us all a more lengthy pilgrimage than was his, accompanied similarly by the possession of our mental faculties to its close.

As we have now about completed the work in which we have been engaged for some time in organizing ourselves into a body corporate, and have got the new machinery into fair working order, we will be able to devote more time to technical and other subjects which may be of interest and profit to us. As I remarked, however, a year ago, we must not now allow ourselves to be persuaded that we have finished our work as an Association. The very idea of organization presupposes an object or objects to be attained entirely distinct and ulterior to the act itself. No body of men would be so foolish as to spend their time and means in perfecting an organization; and surrounding it with regulations, rules and by-laws, if it were not expected that by such means its members would be benefited.

The various societies that are organized throughout the land, and their name is legion, all have definite objects in view, and they are organized in order that they may the better succeed in the accomplishment of these objects; and so Gentlemen it should be with us. We are now in a position to speak with a united voice, and our numbers and the standing of our members throughout the Province are such as to command respect and attention whenever we as a body express our views on questions with which we are familiar.

Without pretending to dictate to those who are in charge of the administration of public affairs, either in the Dominion or in this Province, I think there are many things outside of the issues that divide men politically, that we could with the greatest propriety urge on their attention. I might mention as a case in point, the desirability of proceeding as fast as possible with a topographical and geodetic survey of the Dominion. This matter I believe was pressed upon the attention of the Dominion Government by the Association of Dominion Land Surveyors, and I understand that the latter had received such encouragement as led them to believe that the matter would be taken up systematically in a short time. I would suggest that this Association take some means by resolution or otherwise to strengthen the hands of our sister association in so worthy an object.

Again there has been brought to our notice through the Secretary of the Association of Land Surveyors of Manitoba, a petition by that body to the Dominion Government, relating to the import duty on surveying instruments, and I would call your attention to the matter at present, as the time is opportune if you wish to forward your views to the Finance Minister on the subject.

There is too the old subject of the boundary commission which I think should not be allowed to drop. It is one of those subjects of proposed legislation that has only to be explained in order to be popular in the country, and I wonder that the Patrons of Industry have not adopted it as one of the planks in their platform. Probably the reason is that it has not been brought before their notice.

There is also a matter that I as a private member of the old Association brought up at one of our annual meetings some years ago. I refer to a regular systematic exploratory survey of the unsurveyed portion of this Province. At that time a motion was passed appointing a Committee to lay our views before the Commissioner of Crown Lands. You have somewhere, I believe, a report of that Committee Since that time a limited amount of work has been done in the district of Algoma, but scarcely anything in the way proposed.

I question if there is any other civilized country in the world which possesses so little information concerning its own possessions as our own country. We resemble a man with a large farm who has been contented in working a few acres along his river front, but who has never taken sufficient interest in the larger part of his property in the rear to even explore it.

Now it may be asked : What is the use of gaining this information ? I answer that the Government of this Province has exclusive control over its unoccupied domain, and it is their object as well as their duty to proceed in the most intelligent manner possible in its development. It is the part of wisdom to encourage and direct immigrants only into those parts where they will be able by industry and perseverance to prosper; to take means to preserve from destruction by fire any portions where the timber is valuable, and to encourage as far as possible the miner in developing the hidden resources of the country, but without information they are to a very large degree working in the dark.

The object of such a survey should be to furnish full and reliable reports on the country embraced, including its topography, its elevation above the sea ; its climate and its agricultural timber and mineral resources.

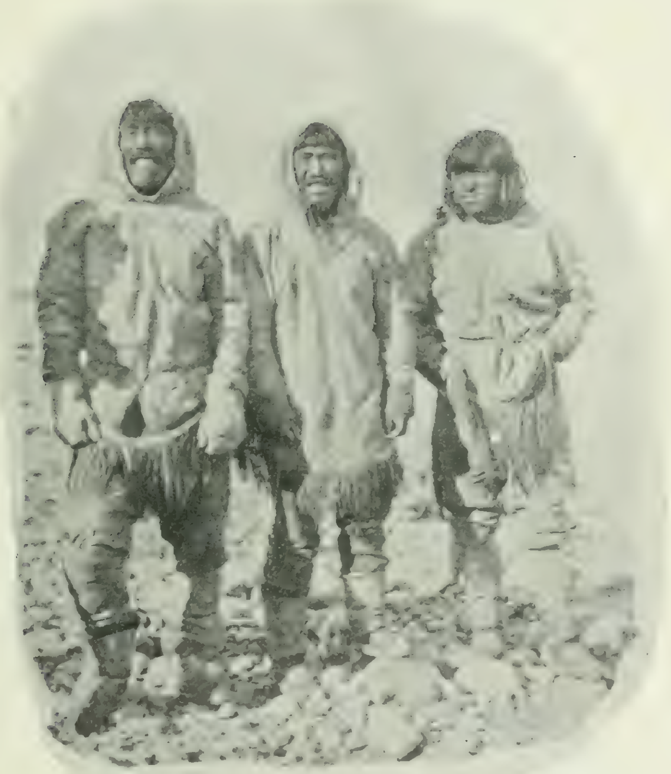
Such a survey would in no way interfere with the ordinary surveys now being made by the Crown from year to year, but be preliminary to them in the way of showing where the latter would be most necessary in the public interest.

These are but a few of the subjects that might be mentioned which I think might with propriety engage our attention.

In resigning the position of President, with which you have honored me for the past two years, permit me to thank you heartily one and all, not only for your uniform courtesy and kindness, but for the assistance you have rendered me in discharging the duties of the office, and the best wish I have for the Association is that the same unity of purpose and harmony of action on the part of its members may continue in the future, that has ever been characteristic of it in the past from its inception nine years ago down to the present time.

I have now much pleasure in asking your attention to the various matters before us for consideration.

E. STEWART,
President.



ESKIMO HUNTERS, CHESTERFIELD INLET.

Illustrations kindly loaned by
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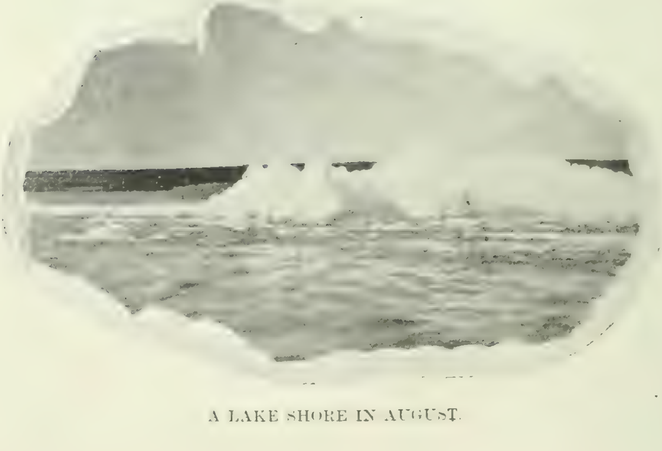
MR. J. W. TYRRELL IN ESKIMO GARB.



A LAKE SHORE IN AUGUST.

PAPERS.

[This Association is not responsible as a body for any opinions expressed in its papers by Members.]

"THE ESKIMO."

By J. W. TYRRELL,
O.L.S., C.E., Hamilton.

The Eskimo—the most northerly inhabitant of this continent—is in many respects a very strange and most interesting character. Probably some of my readers had, within the past few months, an opportunity of seeing a party of them, who were on exhibition at the World's Fair.

It has been the writer's lot to have lived with and travelled amongst the Eskimos for about three years, and during that time he has become greatly interested in them and quite accustomed to many of their peculiar ways.

PERSONAL APPEARANCE.

In appearance these people are short, thick set fellows, with very round, fat faces, usually almost entirely devoid of hair. Their eyebrows and lashes are very small, and against their dark skins are scarcely discernible, so that their brown, oily faces and eyes without trimmings have often a very bare and homely appearance. Their hair, like that of the Indian, is black and straight, and by the women it is worn platted, and twisted up into three knobs, one at either side of the head and one at the back.

The men wear their hair short, cutting it occasionally with a knife, with heavy bangs in front to protect their foreheads from the cold in winter, and from the sun in summer. There are, however, some exceptions to the above description, the writer having met with some really handsome, stalwart men up to the standard height of Europeans, and some very pretty, charming women.

Most of the Eskimos have very bright, soft brown eyes, which of themselves are features of beauty, but they serve these savages a better and more useful purpose: they furnish marvellous powers of vision, enabling their owners to see objects clearly at great distances, when they would be quite invisible to an average white person. As an example of their wonderful powers of sight, the writer will relate a a little incident that once took place during his stay with them. At one time a party of Eskimo hunters had gone out upon the heavy, but floating ice of Hudson Straits to hunt seals. The ice, on account of the strong tidal currents, was so broken and rafted into great piles that it made travelling very difficult and dangerous, but food being scarce, the hunters had determined to go in order to supply the wants of their hungry families. They took with them their kyacks, or skin canoes, to cross the open stretches of water. When walking upon the ice, these would have to be carried on their shoulders and so, alternately launched and hauled out, perhaps fifty times in a day. Such travel is necessarily very dangerous, as the currents caused by the tides are often as swift as those of a great rapid river, causing the ice to whirl, crush, and raft until it forms into immense piles.

No wonder, then, that the families of these bold men became anxious regarding their safety when their absence became prolonged, and days passed, but the hunters did not return,

The writer sympathised keenly with the poor people, and besides doing what he could to supply their immediate wants, walked up frequently with his telescope to a " look out " hill, to, if possible, discover some trace of the absent party. A little daughter of one of the hunters, seeing him one day thus looking for her father, came to where he stood ready to receive any news he might give her ; but she had no sooner reached the elevation of the " look-out " than she, leaping with delight, exclaimed : " Awunga tacko Itatta " (I see father). The writer asked " where," and she pointed away across the glistening field in the direction in which he had just been gazing with the big telescope, and had seen nothing but ice. At first he thought she was mistaken, but turning his telescope again in the direction she pointed, presently discerned away on the horizon a black speck, which sure enough proved to be the returning hunters.

To the writer's naked eye they were quite invisible, and almost so with the aid of the telescope. Soon afterwards as they came nearer he could make them out more clearly, but his eyes, together with the telescope, were not a match for the bright, brown orbs of the little Eskimo maiden, and she in this respect is only a type of her people.

CLOTHING.

The clothing of the Eskimo is made entirely of the skins of animals, chiefly of the seals and reindeer, seal skin being used for summer and reindeer skin for the winter. The skins are nicely softened and dressed with the hair on, and are neatly made up by the women, whose chief duty it is to provide clothing for their husbands and children. The cut of the Eskimo garb is somewhat peculiar, both for men and women.

The accompanying illustration, prepared from a photograph, will convey a better impression of the costumes, than could be given by words alone.

A man's suit may briefly be described as follows : Commencing at the foundation, it consists of a pair of fur stockings or duffles, covered by long waterproof moccasins which reach to the knees, and are just met by short seal or deer skin trousers. The suit is completed by a jacket or jumper, made of the same material as the trousers, which is pulled on over the head, there being no opening in front to admit of it being put on like a coat, This jacket is provided with a hood, which takes the place of a cap, and may either be worn over the head, or pushed back when not required.

In the summer season, a single suit of seal skin, made as above, constitutes a man's entire clothing, but in the winter time he wears two of such suits of deer skin, the inner one having the hair on the inside, and the outer one having the hair upon the outside. The female costume is rather more curious in appearance than the above. The footwear is the same with both sexes, but in place of the trousers worn by the men, the women wear short leggins and trunks, and in place of the jacket a peculiarlv constructed overskirt, having a short, hanging flap in front, and a long train, about the shape of a beaver's tail, just reaching to the ground, behind.

The back of the overskirt is made very full, so as to form a sort of bag in which the mothers carry their children ; and like a man's jacket it is provided with a hood, but of a very much larger size, so as to afford shelter for both mother and child. The women are very fond of decorating their dresses with beads or other ornaments, and all the garments are made with great neatness.

ORIGIN.

As to the origin of the Eskimo people, very little is known, but the most probable theory accounting for their existence on this continent, is that they were originally Mongolians, and at some very early date crossed over Behring Straits and landed in Alaska. This theory is based on the fact that a similarity is traced between the Eskimo language, and the dialects of some of the Mongolian tribes of Northern Asia.

One of the Eskimo traditions would rather seem to bear out this theory. It is something like this : "A very long time ago, there were two brothers who were made by the beaver, and placed on an island in the Western sea. There they lived and fed upon birds which they caught with their hands, but at length food became scarce, and the brothers being hungry, fought for the birds they had taken. This quarrel led to a separation, and one brother went to live in the western portion of our Great North Land and became the father of the Eskimos in that region, whilst the other brother went still farther east and became the father of the Natives north of Hudson Bay and Straits."

IMPRESSION OF ESKIMOS.

The writer's first impression upon meeting Eskimos was that they were a wild looking set. There were thirty-six of them, all women and children, piled into one of their "oomiacks" or skin boats, and all were whooping and yelling at the top of their voices, whilst all who were not paddling were swinging their arms and legs, too, in the wildest manner.

They were natives of Prince of Wales Sound, Hudson Straits, and were coming out from shore to meet the S. S. Alert, which to them was a fiery monster of wonder.

They were accompanied by a party of men in their kyacks, and all were preparing to board the ship without invitation ; but the first officer, by brandishing a cordwood stick, and threatening to hurl it at them if they came too near, and the liberal use of some very strong English, which they did not understand, induced them to await his convenience to receive them.

When past some shoals, near which the ship was steaming, and safely into harbour, the Natives were then allowed to go on board. They were a strange looking lot, and some of them were strangely dressed. One old, grey haired chief had apparently reached a stage of civilization in his attirement not common among the Eskimos, for outside of his seal skin clothing he wore a long, white cotton night shirt, of which he was very proud.

The Eskimos are always pleased with the acquisition of white men's clothing, but their ideas as to how and when they should be worn do not always agree with ours.

Early navigators have described the Eskimos of Hudson Straits and Bay as being savage tribes, greatly to be feared, and it is true that unfortunate crews have fallen into their hands and been murdered by them, but often such tales only come to us half told, the other half dying with the poor savage.

The writer has seen the poor Eskimo, because he was only a savage, receive treatment from white men that would not be tolerated in civilization, but would be met by nothing short of assassination.

No wonder then that these poor, untaught people should be led at times to commit deeds of desperation, for they have their own ideas of propriety and equity. They possess very simple, childish natures, but coupled with much quiet determination and deep jealousy, which, when aroused, is likely to lead to acts of violence. From the writer's experience, he does not think the Eskimos would, without considerable provocation or great temptation, harm any one falling into their hands.

Though not usually quarrelsome or vicious, they do fight with each other, but only at appointed times, when all old grudges and differences of opinion are cleared up at one time. On the appointed day all the disagreeing parties of the camp pair off, and standing at arm's length from each other strike turn about, and in this deliberate, systematic way take satisfaction out of each other, until one of the combatants cries " ta-bah " (enough).

RANGE.

The range of the Eskimo is very large, extending completely across the northern part of North America, and toward the south, to about the 60th parallel of latitude west of Hudson's Bay, but east of the Bay to about the 55th parallel, whilst towards the north their range is practically unlimited.

They are a very thinly scattered race, roving in small bands over a great, unlimited, treeless wilderness.

FOOD.

The food of the Eskimo, as his name implies, is chiefly raw flesh, so that the preparation of his meals is an extremely simple operation, and the culinary part of higher civilization has no place in his life. Reindeer, seals and walruses are to the Eskimo the staple articles of food, but Polar bears, Arctic hares and other animals, beside most of the Arctic birds are considered equally good.

It is rather a novel if not a somewhat repulsive sight, to witness an Eskimo Feast. The occasion of the feast is the capture of a seal, or, perhaps, a walrus, which, according to custom, during the winter becomes common property, and all are invited to the lodge of the fortunate hunter to share in the feast.

The carcase of the animal is trailed into the middle of his lodge, and when all the guests are assembled, they seat themselves on the floor about it. The carcase is then skinned by the host, and the pelt laid down to form a dish or receptacle for the blood.

All things are now ready, and the guests being armed with knives are invited to help themselves, and this they do with great dexterity, and continue to do so, not until they have had sufficient, but until the supply is exhausted, and absolutely nothing remains but the skin and skeleton

The blood, being considered very fine, is dipped up with skin cups or horn spoons and consumed with the flesh.

The blubber or outer layer of fat, which is found on most Arctic animals, is separated from the skin, and cut into long strips about an inch square. Thus prepared, it is swallowed though not eaten. It is simply lowered down the throat as one might lower a rope into a well.

During the summer season the blubber is not used as food, but is saved for reducing to oil, to be used in their lamps during the long dark nights of the next winter·

An Eskimo appears to have no idea of a limited capacity for food, but usually eats on until the supply fails The writer knew of one exception however, where an old woman, after doing heroically, was forced to yield. A party of Eskimos were having a big feast upon the carcase of a whale, which they consider very good food, when she, in her ambition, over-estimated her capabilities, and ate until she became quite torpid. Her friends out of respect to the old lady, supposing her to be dead, trailed her out and buried her in the snow, but a day or two afterwards she kicked off the snow that covered her, and rejoined her friends.

Next to stowing capacity, an Eskimo's stomach is noted for its powers of digestion. For instance, both the flesh and hide of the walrus are common articles of food with them, and these are so hard and gritty that when skinning or cutting up the animal, one has to be continually whetting and sharpening his knife.

The skin of a walrus is a good deal like that of an elephant, and is from half an inch to an inch and a half in thickness; but notwithstanding this, and the hardness of the structure, the little Eskimo children may often be seen running about, gnawing pieces of walrus hide as if they were apples. Sometimes, however, they have no walrus hide or meat of any kind to gnaw, for occasionally in the spring season the condition of the snow and ice is such as to render hunting impossible, and though they store up meat in the fall for winter use, it is often used up before spring.

When this state of things occurs the condition of the poor Eskimo is very deplorable. They are forced to kill and eat their wretched dogs, which are even more nearly starved than themselves, and next they resort to their skin clothing and moccasins, which they soak in water until they become soft, though, perhaps, not very palatable.

DWELLINGS.

Like many people of our own country, the native of the frozen zone possesses a summer and winter residence, and occupies each in turn as regularly as the seasons change. His winter dwelling is built of snow, whilst his summer lodge is made of oil-tanned seal or deer skins, neatly sewn together and supported by poles, if such can be procured, or pieces of drift wood spliced together. A flap is left for the door, but no opening at the top as in an Indian wigwam or tepee, for having no fire they have no need of a chimney.

THE TOPICK.

The atmosphere of these tents or " topicks," as they are called, is usually very sickening to one not accustomed to them, for the skins of which they are made are dressed in their natural oil in order to make them water-proof. This has the effect of making them very rank and odorous. Topicks vary in size according to the wealth or requirements of the occupants. Sometimes they are scarcely large enough to allow two or three little people to huddle into them, whilst others are quite commodious, capable of seating twenty people. The commonest form of a topick is that of a cone, very similar to an Indian tepee, but they are also built rectangular, and sometimes with vertical walls about four feet high.

The furniture of these dwellings is very simple, consisting usually of a few skins lying about the rocky floor to serve as seats in the day time and bedding at night ; two or three seal skin sacks of oil, two shallow stone vessels used as lamps, a few hunting implements, some little deer skin bags, used as ladies' work baskets, several coils of seal skin line, a few pairs of moccasins scattered about, and at one side of the door, the somewhat repulsive looking remains of a carcase consumed at the last meal. Such is the Eskimo summer house.

THE IGLOE.

His winter dwelling in the snow is rather more interesting and curious. It is called an " Igloe," and is built in the form of a dome with large blocks of snow. A common size of the dwelling apartment of an Igloe is twelve feet in diameter and eight feet in height. This is approached by a succession of three or four smaller domes connected by low archways, through which one has to crouch low in order to pass. The innermost archway opening into the dwelling apartment is about three feet high, and as one enters, he steps down a foot or more to the level of the floor of the front portion of the dwelling. The back part, about two-thirds of the apartment is three feet higher than where one enters. The front or lower section of the Igloe corresponds to a front hall, and it is in it that the occupants as they enter beat the snow off their clothing, or remove their outer garments, when they wish to step up into the higher living apartment. The floor of the entire Igloe consists simply of snow, but in this upper apartment it is well covered with deer skin robes, so that it is not melted by the warmth of those who sit or lie upon it. Above the doorway of the Igloe is placed a window to admit light into the dwelling. This is formed of a large square slab of ice, neatly inserted into the wall of the dome, and it serves the purpose for which it is intended exceedingly well, admitting a pleasant soft light. Above the window a much needed ventilating hole is usually made. This, because of the passing current of warm air, becomes rapidly enlarged and requires to be frequently plastered up with snow. Sometimes one of the long approaches or corridor porches is made to serve for two or three dwellings, each of which is connected by low archways with the innermost of the smaller domes. Usually opening out of the smaller inner dome, each family has one or two small pantries, where they keep a supply of meat sufficient for a week or two.

ESKIMO LAMP.

The furniture of the snow house is much the same as that of the skin "topick" already described, but the stone lamps come more into prominence, contributing light to the dwelling during the long, dark winter nights. These lamps are simply shallow stone vessels, usually half moon shaped, and formed neatly of some description of soft rock. The rounding side of the vessel is made much deeper than the other, which gradually shoals up to meet the edge. The wick of the lamp consists of dried, decomposed moss, pressed and formed by the fingers into a narrow ridge across the shallow or straight edge of the lamp. In this position it absorbs the seal oil which is placed in the vessel, and when lit, burns with a clear, bright flame, free from smoke. The lamp is then made self-feeding by suspending above it, at a height varying according to the amount of light and consequent supply of oil required, a lump of seal blubber. This melts with the heat of the flame and drips into the vessel of the lamp, and keeps it supplied for a considerable length of time. The supply of oil, which means the intensity of light, is increased or diminished at will by lowering or raising the lump of blubber suspended above the flame. One lamp is usually placed at either side of the entrance in the upper apartment. Both are kept burning brightly the greater part of the long, cold, dark days of winter, but during the hours of sleep they are "turned down," that is the lumps of blubber are hoisted; or sometimes one lamp is extinguished and the other burned low. These lamps, though chiefly designed to furnish light, do also furnish a considerable amount of heat to the Igloes It is often necessary to "turn them down" to prevent the snow walls from being melted by the heat, though the temperature outside may be forty to fifty below zero.

Towards spring the snow houses become very damp, and to prevent the roofs from being melted away, fresh snow has to be added to the outside. Before they are abandoned for the skin tents, they sometimes become so soft that they cave in upon the occupants, and often cause much sickness in the form of colds, pneumonia or mumps.

The building of an Eskimo Igloe is by no means as simple a task as one might suppose. In the writer's first attempt to build even a little one, he grievously failed, and upon the next opportunity found it interesting to learn the art from the native workmen. The snow upon the bleak, barren lands is driven and packed hard by the cease-winds and gales, which hold high carnival in those regions, and is admirably suited for building purposes. The first thing to be done toward the building of an Igloe is the selection of a sheltered site, not in some thick woods, as there are no trees in the Eskimo country, but on the lee side of some convenient hill, if possible beside a lake or pond of deep water, which will not freeze to the bottom during the cold winter. The spot having been chosen, the snow is quarried from it in the form of large blocks from two to four feet square and eight or ten inches thick. The snow is thus excavated to within about one foot of the ground, and with this preparation the building is commenced by placing the blocks upon edge in the form of a circle, and closely fitting them together. As the Igloe is to be built in the form of a dome, the walls must all lean inwards towards the centre. It is this peculiarity that bothers the unskilful workman. The Eskimo overcomes the seeming difficulty, however, in a very simple way by carrying the walls up in the form of a spiral, so that each succeeding block is supported and held in position by the block previously laid. That is, each block is supported on two edges or rests in a notch, instead of on a level wall. By this method of construction the walls are readily and rapidly raised, until they are completed by one large crowning block. The doorway is cut in the wall after it is largely built, but before the roof has been closed in, and then the interior is shaped by excavating or packing in snow solidly where required. The outer passage way is then built in such a position as to best resist the influences of the weather. The cutting of the snow is done with long thin ivory knives, neatly made for the purpose, or sometimes with long steel knives or saws, when such can be obtained.

WORKMANSHIP.

In their workmanship the Eskimos are very neat. Wood is used for manufacturing purposes when it is available, but all they are able to procure is fragmentary pieces which have drifted from some far distant shore, or from the wreck of some unfortunate whaling vessel. It is from this rough material and very scanty supply that they make their sleds, frame their kyacks, get their tent poles, make handles for their spears and harpoons, make their bows, and a hundred other things; and through their untiring perseverance and skill, they manage to produce marvellous results. For example, a paddle is often made of two or three pieces of wood, but so neatly joined together, that if it were not for the seal thong lashings, the joints would not be noticeable. The lashings are put on green, or after having been softened in water, and are drawn tightly, so that when they become dry and shrink, they produce strong and very rigid joints.

The processes by which these lashing thongs, and heavy lines for hunting purposes are manufactured, as well as the small thread for sewing, are very interesting. A heavy harpoon line used in the hunt for securing walruses, is made from the skin of the square flipper seal, a large variety about eight feet long. For such use the skin is not removed from the body in the usual way by cutting it up the belly, but is pulled off without cutting it, as one might pull off a wet stocking. The whole hide is thus preserved in the form of a sack, which is placed in water and allowed to remain there for several days, until the thin outer black skin becomes quite decomposed. This, then, together with the hair is readily peeled off, and a clean white pelt remains. Two men then take it in hand, and with a sharp knife soon convert the sack into one long, even, white line, by commencing at one end and cutting around and around until at length the other is reached. One skin in this way will make three hundred feet of line. In this condition it is allowed to partially dry, after which it is tightly stretched and dried thoroughly in the sun. The result obtained is a hard even white line, three-eighths inch in diameter, but equal in strength to a three inch manilla rope.

The writer has seen such a line, when imbedded in the flesh of a walrus at one end, and spiked to the hard ice at the other by a stout iron pin, as well as being tugged at by six men, plough a furrow six inches deep through the ice, bend the spike and drag the six men to the edge of the ice, where the tug-of-war ended, the walrus being victorious, and taking the unbreakable line with him into the deep.

Smaller seal thongs, such as are very extensively used as lashings for komiticks, kyacks, handles, etc., are made in much the same way as the above, except that they are made from the hide of smaller seals, and often the process of removing the outer black skin is omitted, and the hair is simply scraped off with a sharp knife or scraper.

Finer lines, such as those used for fishing or winding a whip stock, and thread for sewing purposes, are manufactured from reindeer sinew, the best being that obtained from along the spine. The sinew from this part of the deer is always saved. It is prepared for use by first drying, and then rubbing it until it becomes quite soft, when it is readily frayed out into fibres, in which condition it is used for fine needle work; but when coarser thread or stout cord is required, these individual threads are plaited together, and with wonderful neatness and rapidity. One woman in a day can manufacture fifty or sixty yards of this sinew cord or thread.

Just here it would be well to note, that with the Eskimos all joints of whatever kind are secured by these thongs, they having no nails or screws, such as we have, to supply their place. In making a sled or komitick, the cross slats are all secured to the runners by seal thongs. In framing a kyack the numerous pieces are all lashed together, usually with seal or deer skin, though sometimes, and preferably with whalebone.

THE KYACK.

The Eskimo " Kyack," or canoe, is a peculiar craft. It consists of a light frame neatly made from all sorts of scraps of wood, and strongly jointed together as stated. The frame having been completed, it is then covered with green skins, either of seal or deer, dressed as above described with the hair removed. The skins are joined to each other as they are put on by double, watertight seams, and are drawn tightly over the frame, so that when they dry they become very hard, and tight as a drum-head.

A full-sized kyack thus made is about twenty-two feet long, a foot and a half wide and a foot deep. They are completely covered over on the top excepting the small hole where the paddler sits, so that though they are extremely cranky crafts in the hands of a novice, they are commonly used, even in very rough water, by an expert. Indeed, the Eskimos have an arrangement by which they can travel whilst almost submerged in the water. They have a thin, waterproof parchment coat which they pull on over their heads in rough weather. This they place on the outside of the rim at the opening of the kyack and tie securely, so that if the boat were to turn upside down the water could not rush in. An Eskimo in his kyack can travel much faster than two men can paddle an ordinary canoe. The writer has known them make six miles an hour in dead water, whereas four miles would be good going for a canoe.

THE KOMITICK.

The Komitick is a sled of rather peculiar design. It consists simply of two parallel runners, twelve or fourteen feet long, built of wood, and placed about eighteen inches apart, upon the top of which are lashed a number of cross bars or slats. The runners are shod either with ivory or mud, the latter answering the purpose exceedingly well. The mud covering is, of course, put on in a soft state, when it can be easily worked and formed in proper shape. When the mud is on, and the surface nicely smoothed off, it is allowed to freeze, and speedily becomes as hard as stone. In order to complete the komitick and put it in good running order, there is one thing yet to be done The shoeing, whether of mud or ivory, has to be covered with a thin coating of ice. In order to do this the Eskimo overturns his komitick, fills his spacious mouth with water from some convenient source, and then from his lips deposits a fine, even stream along the runner, where it quickly freezes, and forms a smooth, glassy surface.

During the winter season the komitick forms an important factor in the Eskimo's life. It is drawn by a team, not horses, nor even reindeer, but of dogs. The number of animals forming a team varies greatly, sometimes consisting of not more than three good dogs, but at other times fifteen or more are attached to a single sled. Each dog is attached to the komitick by a single line, the length of which varies directly as the merits of its owner. Thus the best dog in the team acts as leader, and has a line twenty or twenty-five feet in length.

THE WHIP.

In order to control the team the driver carries a whip of rather extraordinary dimensions. This intrument of torture has a short wooden handle only about eighteen inches long, but what is lacking in stock is more than made up in lash, for this latter, made of the hide of the square flipper seal, is about thirty feet in length. An Eskimo can handle his whip with great dexterity, being not only able to strike any particular dog in the pack, but any part of its body, and with as much force as the occasion may require.

The writer's first attempt at dog driving was anything but successful. The experience was gained in January, 1885, on Big Island, Hudson Straits. when one day, having been confined to the house for some time on account of the bad weather, which was still unpleasant, he determined to take recreation by going for a drive with his dogs. Accordingly after breakfast an Eskimo servant was instructed to harness the team, whilst he proceeded to dress himself warmly in deer skins. A few minutes later both dogs and master were travelling at a break-neck speed down the slope of the land to the harbor ice, but when the ice foot was reached, being the time of low water, a perpendicular drop of about thirty feet was met with, and very naturally the dogs refused to go down. A broken place in the icy wall was however found, and after a great deal of exertion on the part of the writer and a vigorous application of the whip, which more than once lashed his own face, the dogs were all safely landed on the level harbor ice. But here they were exposed to the sweep of a cold north wind, which drove the snow in their faces; and so they positively refused to go. The writer, however, having set his mind on crossing the island towards the north endeavored in every conceivable way to urge on his balky steeds, but unfortunately, being a novice at dog-driving and the use of the Eskimo dog-whip, he was forced, after two hours of desperate exertion, to acknowledge defeat, for then the stubborn animals breaking away, made a successful run, until they were again stopped by the perpendicular wall of the ice foot.

When the writer came up to his runaways, he did not attempt to again shape courses, but assisted them up the icy precipice and let them go, having obtained quite as much recreation from his drive as he had hoped for. In later attempts at the Eskimo mode of winter travel he has been more successful, and enjoyed many a komitick drive across the snowy wilderness.

DISCUSSION.

Mr. Sankey—In moving a vote of thanks to Mr. Tyrrell for his interesting paper, a few remarks may not be out of place. In the early history of our Association all the papers read before it were more or less of a technical character, and I think, perhaps, we have fallen into the idea that every paper read before this Association should consist of something strictly technical, something that pertains to the duties of a surveyor as such, and, in fact, I think that this idea has gone so far that, perhaps, some people imagine we should not have papers, except on strictly surveying lines, that even matters relating to kindred professions, some of which our own members practise, such as engineering, etc., should not find a place on our programme; but I think we are most fortunate to have a member of our Association and profession, such as Mr. Tyrrell, who is able to give a personal guarantee of genuineness to the interesting paper we have just heard read Surveyors in Canada and the continent of America have no doubt been the forerunners of civilization; much that is known of the early history of this country is associated with the surveyors, and I think we are most fortunate in having men like Mr. Tyrrell, and others whom I might mention, members of our Association, to write such papers as this. and I hope the day is far distant when papers like this and others on similar subjects will not be gladly put on our programme and cordially received.

☞ The President—I think we are very much indebted to Mr. Tyrrell, for this paper. There is one question I would like to ask, that is, how do they light their fires, do they use matches or what?

Mr. Tyrrell—They use a flint and steel when they can get it, but, perhaps, more commonly produce a flame by the rubbing of one stick upon another. It is not an uncommon thing in the neighborhood of old Eskimo camps to find fragments of wood having round charred holes worn in or through them by this fire-producing method.

[This Association is not responsible as a body for any opinions expressed in its Papers by Members.]

HOUSE DRAINAGE.

By M. W. HOPKINS,

O.L.S., C.E., Hamilton,

The drains of a house should be kept from underneath a house as much as possible, and all pipes inside of the walls of the house should be above ground, and easy to be seen, when circumstances will permit.

They should not be run along close to the foundation and parallel to it; because this would cause the foundation walls to be undermined in time. When they enter underneath the house they should be made to pass under a window or door to lessen the pressure on the drain. Drains are very likely to become leaky by the pressure of the wall crushing them out of shape, as the house settles after some years.

Outside of the house the drains can well be composed of fireclay, provided the iron is run out from three to ten feet from the wall. But inside of the foundation walls the drains should be composed of iron, because:

(1) Iron is stronger and will not break.

(2) The joints can be made to endure.

The soil-pipes should be composed of iron. We generally find soil-pipes leaky, because lead soil-pipes are usually made too light, and those that would be thick enough to stand would be very costly and not so efficient, all things considered, as extra heavy cast iron, well jointed with lead and gasket. The latter if periodically examined and repaired will remain reasonably tight. A soil-pipe of good drawn lead and seamless, if heavy enough, is good. Galvanized iron soil-pipe ventilators are untrustworthy, and cannot be depended upon to remain tight for any length of time, even if tight when constructed. They should be condemned.

It is seldom necessary to make the drain of a private house greater than four or five inches in diameter, and it should never be less than three inches, as it is liable to become choked with sticks, etc.

Many house drains in Montreal, and some in Hamilton are nine inches in diameter, which become foul unless they have a great fall and even then. The trap on the main drain should never be greater than six inches in diameter. A larger one is very liable to choke for it contains more water than any flush of fixtures in the house will supply, and hence it cannot be properly flushed out.

The soil-pipe should not be less than three inches in diameter, nor more than five inches.

The waste pipes of basins, baths, sinks, etc., should be one and a half or two inches in diameter.

GRADIENT.

The minimum gradient for a drain is about one half inch in a yard or 1 in 72. A good rule to find the gradient for a drain is to multiply the diameter in inches by 10. For example : A four inch pipe should have a fall of 1 inch to 40, etc. This rule will apply to drains or sewers of very large dimensions as well as to the smallest pipes. Of course it only holds where the drains ordinarily run about half full. It will not apply, for example, to a nine inch drain with only enough water running through it for a four inch drain.

The least admissible for a lead waste pipe is about 1 in 100. Iron requires more.

In a position where it is impossible to get sufficient gradient for a pipe with a given diameter, it may be possible to lay one with a smaller diameter, as between the ceiling and the floor of the next ceiling, since ;

(1) You can get more fall with the smaller pipe.
(2) A small pipe gives a greater velocity.
(3) It has less surface to clean.

JOINTS.

All joints between iron and lead should be made by means of a brass thimble soldered to the lead, and the space between the brass and iron should be run in with lead and hard staved.

Joints between iron should always be soldered with lead if they are connected with the drains.

We find a good many slip joints between iron and galvanized iron soil-pipe ventilating pipe, and they always leak badly of course.

Joints of fire clay pipes are made by means of oakum or hemp and cement, or by Portland cement mortar. Red lead may be used for joining outside iron pipes ; but neither this nor putty should be used for joints between two metal pipes inside of the house if the pipes are connected with the drains. Rosin and grease, or red lead and putty are sometimes used to join the earthenware water closet to the soil-pipe branch. There are better methods now.

TRAP VENTILATION, ETC.

Every drainage system should be ventilated by continuing the soil-pipe, full diameter, up through the roof, and fresh air should be admitted into the drain by an inlet pipe, at least as large as the soil-pipe, taken from the drain a few feet above the trap. If this is done fixtures near the soil-pipe need no other ventilation ; but if at a distance from it, a 1½ or 2 inch air pipe should be taken from the crown of the trap and run through the roof or into the soil-pipe above the highest waste connection, or an air pipe can be passed up beside the soil-pipe and receive the smaller pipes from the crowns of the respective traps. Smaller pipes should be increased to four inches diameter above the roof to prevent them freezing. Experience has shown that the fresh air inlet will not freeze in Montreal or Hamilton, and it should be taken from the drain a few feet above the trap to prevent the water therein freezing. Besides the top of the soil pipe ventilator is not so apt to freeze with the current of air in it caused by the fresh-air inlet. The trap should be from 3½ to 5 feet below the surface to prevent the water in it from freezing.

Rain conductors should not be used as ventilators for the drains, but should be tapped at the foot if near any window. Rain conductors will not act as ventilators while it is raining, and they invariably burst in the winter in cold climates if they are on the outside of the house. Cess pits should not be permitted in cities as a rule, but as they do exist, they are somewhat a lesser evil when ventilated by two good sized pipes, a high one and a low one—one for exit and the other for entrance of air.

Water-closet apartments should be carefully ventilated. Of course no ventilator of the drains should be run into a room ventilator, which we have sometimes found to be done.

Foul air pipes are sometimes erroneously run into the chimney, when a down draft will fill the rooms with sewer gas. Sometimes the pipe is continued inside of the chimney to its top in order to get an upward draft in the ventilating pipe. This is objectionable as the pipe is soon eaten through, and the foul gas escapes into the chimney.

LOCATION OF FIXTURES.

Wash-hand basins are objectionable in bedrooms unless their waste pipes discharge openly over the bath, tubs or some other appliance as a specially trapped funnel. All the basins may be run into a single larger pipe, and this latter pipe made to discharge openly as described above.

No fixture should be placed in a dark corner, because it is likely to be neglected and become unsanitary; besides it will often be but little used when so situated, and if it is but seldom used it had better be cut out. Water closet apartments should not be too small, and, if possible, receive light from a window in the outside wall.

Water closets should be provided with a safe tray. We have seen water closets on one floor directly above the cistern on the floor below, not provided with a safe tray. The foul water from around the water closet leaks down into the cistern below, and mingles with water that is sometimes used for drinking and cooking purposes.

TRAPS.

Disconnection from the public sewer is one of the most important points in a good system of house drainage, and when there is a trap between the sewer and the house, there should also be a fresh air inlet to give a circulation of fresh air in the pipes. If there is no trap, of course, there will be a circulation of air from the sewer, but this will be foul air, and in case of a leakage is liable to spread disease from the lower and disease producing part of a city. The best trap for this purpose is the " Buchan " trap.

(1.) This trap shuts off the disease from the sewer.

(2.) It gives an opportunity to have a circulation of fresh air in the drainage system.

(3.) It gives a convenient point and excellent opportunity for inspecting and cleaning the drain.

(4.) It makes the smoke or other test much more efficient by preventing the smoke, etc., from escaping into the sewer.

(5.) It also provides for a fresh air inlet.

(6.) It has a cascade action of three inches fall that thoroughly scours it out if not too large.

The trap should be placed outside of the house in a place easy of access, and its cleaning and inspection eye should be brought straight up to the surface, or within a few inches of the surface, and covered with a close-fitting iron plate, which can be easily removed when desired. This trap very seldom chokes.

The waste-pipes of baths and basins should always have separate traps close up to the fixture, and should never run into the trap of the water closet, which is yet often found. Sometimes the waste pipes are separately trapped and also run into the trap of the water closet. No pipe should be double trapped, without ventilation between and even then the second trap is only an impediment to the drain.

The seal in a wash-hand basin should be from three to four inches. A sink trap should have 1½ inches, and a water closet trap 1½ inches.

Bell traps should not be used inside of the house for many reasons :—

(1) They are nearly always choked.
(2) They become foul.
(3) When the top is lifted off the sewer gas comes up, and
(4) The top is often left off.

FLUSHING, ETC.

All water closets of wash-out or wash-down pattern should be flushed by means of 1½ inch siphon service pipes from special cisterns regulated to discharge at least four gallons at each flush. This is economizing water for it is using it where it is needed.

A very grave mistake is to connect the overflow pipe of the cistern with the soil pipe or some pipe connected with it. The overflow pipe so connected is often trapped in the cistern, but this only lessens a greater evil. This trap evaporates empty if the ball cock remains tight for some time.

Cisterns from 3 to 8 feet high should have a 1½ inch service pipe ; those higher than 8 feet a 1¼ inch pipe, and those lower than 3 feet a 2 inch service pipe.

No pipe should be allowed to sag sufficiently to retain water. This is still worse with hot water pipes. The least it can do is to make a disagreeable noise.

BATHS, SINKS, ETC.

It would be a great improvement if baths, sinks, water closets, etc., were put up without any, or very little, wood work. The baths and sinks would then stand on legs, and would not require any wood work; while the water closet would only require to have the lid composed of wood. If the water closet were also used as a slop sink, which is an excellent plan, it would require a double lid. both of which would be raised when the slops were being discharged. Under and around the baths and water closets thus put up should be laid tile of suitable patterns. A bath room of this kind looks inviting and the cost is moderate.

A very good material for sinks and wash-tubs is glazed earthenware

The common lead slop-sink is a filthy appliance. If made of glazed earthenware and of the hopper pattern it is passable, but in all slop sinks the space beneath the grating becomes foul and emits a disagreeable odor if it doesn't retain and spread germs of disease.

The common bath with a plug, and the water running in from above, is the most cleanly and best pattern of bath.

Baths, basins, sinks, etc., should be supplied directly from the pressure main. There should never be ground cocks on pipes under high pressure. Screw down cocks are safer, as they do not stop the flow so suddenly. Besides ground cocks wear away quickly.

HOT WATER CISTERN.

Hot water cisterns should—

(1) Be always close covered.

(2) Have a steam pipe.

(3) Have a check valve to prevent the hot water from running back into the cold.

The cold water cistern should not be used to supply the boiler and water closet both, nor should it be placed in the water closet apartment.

There are now hot-water tanks supplied direct from the pressure main which are excellent.

WATER CLOSETS.

The "Old Pan" water closet, so common, is now condemned by all sanitary authorities as a filthy and unsatisfactory appliance.

The best water closets are of the wash-down pattern. If flushed as described above they are as cleanly and healthful as can be desired. The valve leading to the service pipe should be half inch larger than the latter so as to (1) Fill the service pipe and start the siphon at once, and (2) So that sufficient water will press in to keep the air from mingling with it. If this is done the noise, so often attending the flush will not be, and the stream will be more compact and give a better flush.

The wash-down pattern of the water closets is completely above the floor and consequently works above board.

In examining the arrangements of houses there is generally much difficulty in seeing the pipes, as they are generally concealed inside the partition walls. This not only makes it difficult to examine the pipes but also makes it very troublesome and expensive to repair small leakages occurring in the concealed portion. All pipes should be exposed to full view, or only covered with a board that can be easily unscrewed off.

This short paper covers some of the most common mistakes made in the drainage of houses.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

THE LAKE OF THE WOODS AS A MINING CAMP.

By HENRY DeQ. SEWELL,
O.L.S., A.M.I.C.E., Eng., D.L.S., Port Arthur and Rat Portage.

At the last Annual Meeting of this Association I attempted to give you an account of gold mining as it had occurred under my own observation in a comparatively limited and unknown area, viz., Taché, and I endeavored to show what could be done towards promoting our mining industries by a few energetic individuals, and how, if it were only properly followed up, many of the stations on our great national railway, the Canadian Pacific Railway, might be profitably turned into mining camps, or bases for mining camps, and thus contribute materially towards the exploration and development and consequent prosperity of the vast and material wealth of this country. It has thus naturally occurred to me, on being asked to contribute a paper at this meeting of the Association, to give you a description of an older, larger, and much better known mining camp in the same district, viz., "*The Lake of the Woods*;" and whilst it covers and is distributed over a much larger area than those near Taché, I trust itmay be deemed a fitting sequel to the former paper, and will, I hope, prove equally interesting and instructive, and thus help to draw attention and capital to the comparatively neglected science and industry of mining, that has hitherto been so overlooked and neglected in Canada, and which, if judiciously and properly followed out, is one of the richest and most profitable of the industries of this country.

For the purpose of this paper, I think it will be sufficient to describe the position of the "*Lake of the Woods*" by saying that Rat Portage, which lies at the entrance of the Winnipeg River (the principal outlet of the Lake on the north shore), is a station on the Canadian Pacific Railway in Lat. 49°, 27′ N., and Long. 94°, 44′, W., being 293 miles west of Lake Superior, and 133 miles from Winnipeg. The Lake extends from Rat Portage on the north to "Hungry Hall" at the entrance to Rainy River, for a distance of about seventy miles, whilst from the extreme east to the extreme west of the Lake, the distance is nearly 100 miles, having an area of about 1600 square miles. This extensive sheet of water is literally dotted over with thousands of islands of most varied forms and shapes and in endless variety of color, far surpassing in beauty and grandeur anything else of its kind on this continent, that the author has ever seen, whilst at the same time it affords a most easy and economical means of access to the mines, that lie scattered along its shores. Such is the outline of the "*Lake of the Woods*," which, together with the adjoining mainland, forms the limits of the area that I propose to describe. As, however, the Laurentian formation predominates in the southern part of the "Lake of the Woods," our attention will necessarily be chiefly confined to the northern part of the Lake, the formations of which are mostly composed of the Huronian or Keewatin formation, intersected with considerable belts of Laurentian rocks. There are many minerals found within this area, but gold is the one principally sought for, and therefore is the one with whom we are mostly concerned. It is found chiefly in quartz veins that occur in the Keewatin formation, although the most promising veins are mostly found in near proximity to the Laurentian, whilst lying in the Keewatin, which is the true gold-producing rock. The Huronian, or more properly speaking the Keewatin formation, thus occupies a considerable tract of territory on the Lake of the Woods as well as on the south of Rainy Lake, where it meets the higher series of the Couchiching group. The typical Keewatin consists of greenish or greenish grey strata, with a dip nearly vertical; the principal portions having a slaty structure, consisting of chloritic, argillacious talcose, silicious dioritic and fine grained micacious slates, with interstratified beds of diorite, frequently much tilted. It is from these slates at or near the line of contact with the Laurentian granites and gneisses, we look for, and frequently obtain, our best results of gold-bearing ore.

THE SULTANA.

The Sultana is a most interesting property. It is situated about eight or nine miles east of Rat Portage, on the north shore of the Lake of the Woods. During the past two years considerable exploring work has been done on it. Latterly, however, a shaft has been sunk to the depth of 105 feet. At 68 feet, (the first adit level), drifting east and west along the vein is being carried on, whilst sinking goes on at the bottom. They have at present a force of thirty men employed. The dimensions of the shaft are 14 × 8, and that of the drifts 7 × 5. The strike of the main lode is north-east and south-west, with so far but little perceptible dip. Average width of the vein is 4′ 6″, composed of fine sugar quartz. Average value of the ore is $15.50 per ton of 2000lbs. The mill consists of ten stamps, with amalgamating plates, and two improved Frue vanners. They have also a cyanide of potassium plant of the MacArthur-Forest type for the special treatment of more refractory ore: so far, however, they have not required to put this plant into active service. They want steam pumps and hoists badly, and were these provided, the mine would assuredly make a much better return than the solitary gold brick, which is brought into Rat Portage every week. In fact it is needless to say that under proper management, this property, which has abundance of ore averaging $15.50 per ton of 2000lbs., would undoubtedly yield handsome dividends.

(Since writing the above they have purchased three air drills and compressor plant.)

THE GOLD HILL.

The Gold Hill or Northern Gold Co. is in the same formation as the Sultana. The main or Ada G. shaft is down to a depth of 66ft., while the Pearl shaft on the Pearl lode is 61 feet deep, with a drift commenced in a 4 foot vein at this depth. These veins run parallel with each other, their strike being north-east and south-west. Average width of veins 4 feet, dip 10° S. The shafts are 8′ × 5′. Average assay value of ore from both shafts, $17.50 per ton of 2000lbs. A ten stamp mill has lately been erected. This and the Sultana are the only mines in the district that are really getting into fair working order. They have 25 men employed systematically in sinking and drifting on both veins, with an additional 5 men employed in attending to their mill and reduction works. The results in the way of gold products are, I am assured, most encouraging. This property is situated on the east shore of the Lake, and about four or five miles from the Sultana.

THE BULL DOG.

The Bull Dog adjoins the Gold Hill mine; it has a shaft sunk 80 feet with some drifting east and west along the vein, which is 3′ 6″ wide and the ore assays from $10 to $70 per ton of 2000lbs. This mine owns and operates a steam drill, hoist and pump. Hitherto they have had a Crawford mill, but as this machine has proved a complete failure, it has been removed to make way for the old-fashioned but reliable stamps. The shaft is 5′ × 8′. This is a promising property, and one that has every likelihood of turning out a paying concern. Near the Bull Dog is

THE WINNIPEG CONSOLIDATED.

This is a property that has been shut down for years, owing to work having been commenced before a title to the land had been secured; they sunk a shaft to a depth of 104 feet and put up a five stamp mill on the property; the vein measured only eight inches at the surface; but at the bottom of the shaft it was nearly eight feet wide. The ore averaged over $22 per ton of 2000lbs. Of course no company could possibly last without some prospect, no matter how remote, of one day obtaining possession of the land on which they were operating. Consequently the Company collapsed, and the property has fallen into the hands of parties who want a good price, and who are likely to continue to want it.

PINE PORTAGE.

Pine Portage is about one mile east of the Sultana, on the mainland; it is one of the strongest and best defined veins on the Lake. The vein is about 6′ to 7′ wide. The shaft is sunk at the junction of an east and west vein with a north and south fissure vein, the drifting being done on the fissure vein. The ore is black in color, and is extremely refractory. It averages $12 per ton, although some assays have gone as high as 22 oz, or $4.40. The shaft is 120ft. deep and the drifts and cross cuts amount to 150 feet. They have erected a ten stamp mill and Frue vanners. The work was done at the same time as the Winnipeg Consolidated, and had the ore been as suitable as the others that I have already mentioned for economical working, it would probably have been a working mine to-day. Unfortunately, as a result of this mine closing down, chiefly owing to the presence of tellurium in its ore, the public generally seem to have come to the conclusion that the Lake of the Woods ores are generally full of tellurium and are consequently very refractory. This conclusion is, however, not borne out by assays and subsequent developments. Generally speaking, the Lake of the Woods ores are comparatively free milling for some distance down from the surface, after which they are mostly affected with iron, sulphur and copper only, thus necessitating the use of some concentrating process, but not by any means such an expensive process as the presence of tellurium has hitherto demanded, and which in the case of Pine Portage resulted in the closing down of the mine.

THE TREASURER.

This has been sunk 53′ 6″, with a cross cut of 10ft. Average width of vein, 3′ 3″. Average value of ore, $16.25 per ton of 2000lbs. It is a promising prospect.

THE L' DI VERE.

This is owned by the same party as the Treasurer and has been sunk 100 feet, the average assay being from $10 to $20 per ton of 2000 lbs. There is a steam hoist on this property. The width of the vein is about three feet.

THE WILD ROSE.

This is situated near L' Di Vere and the Treasurer. It contains a very promising vein 3 feet wide of good looking quartz, yielding from $10 to $27 per ton of 2000lbs. It is a property of considerable promise, situated as it is in the very heart of the auriferous mining belt.

THE BAD MINE.

This is another favorable prospect on which active development is now going on with a view to purchasing it, should the present developments warrant it. One interesting feature of this property is that the vein occurs in the Laurentian formation instead of in the Keewatin or at the junction of these formations. Consequently the developments are extremely interesting from a geological standpoint. These last four prospects are situated near Rossland Station, on the Canadian Pacific Railway, about 8½ miles east of Rat Portage, and I have selected them as fair samples of many prospects which exist on the Lake of the Woods, such as Britannia Island, Cariboo, Woodchuck, Argyle, Regina, etc.

In conclusion I may say that I regret that I was only a comparatively short time at Rat Portage last year, and that during that time I was extremely busy, or I have no doubt that I should have been able to have gathered together more data of this very interesting gold field, whch is still very much in its infancy. Enough development has, however, been already done to prove the existence of gold in paying quantities, and also to prove that there are many really good claims that are still undeveloped, and that in order to secure a good paying mine, it is not necessary to invest in and develop one of the most ancient mining locations, which appears to have been the general practice so far, but that it is equally safe to invest in and develop recent mining claims, which, if carefully selected, are just as likely to turn out well. It will thus be seen that the Lake of the Woods is a very promising locality for anyone who may desire to experience the pleasures and profits of gold mining. The ores are generally easily milled, the veins are of fair width, and although so far none of them have proved very rich, good paying veins can be secured, that will carry on an average from $10 to $17 per ton of 2000lbs. The known gold area is constantly increasing, promising free gold finds having been found on Manitou Lake, La Seine River and the south part of Rainy Lake. In fact, owing to the rich discoveries of gold, and also coal on Rainy Lake, our American cousins have not only laid out a townsite on the American side in the State of Minnesota, about fourteen miles east of Fort Francis, but they intend building a railroad from Tower and Ely to Rainy Lake. In fact, the country may be considered as almost entirely unexplored, the few properties now under development having been found more by accident than as a result of systematic and careful search. So that there is ample scope left for the explorer and miner to win for themselves the profits, which properly belong to the careful and assiduous searcher in Nature's laboratory.

DISCUSSION.

Mr. Gaviller—Were the results as to the percentage of gold obtained from an assay, or from crushing the ore on the ground?

Mr. Sewell—Mostly from actual practice, from mill tests. A good many of my averages are much lower than you could get from an assay.

Mr. Gaviller—I gathered from your paper that the mill had not been used to a great extent, and, of course, while your plates are being amalgamated there is a good deal of gold lost, and the results are not fair unless they had been working for some time. Of course an assay is a totally different thing from putting the ore through the mill.

Mr. Kirkpatrick—Did I understand you to say there was coal found on the American side?

Mr. Sewell—Yes. They claim you can follow any of these little streams on the south side of the Rainy River, and you will find little lumps of coal on the bars. They also claim that at the Rapids there is a seam of coal going through, but I did not see it. I see by the papers since that they they claim to have discovered it on the American side. It is lignite coal.

Mr. Kirkpatrick—I would suggest that instead of giving the local names of the mines, such as "Bull Dog" mine, "Bad" mine, etc., you give the mining location, number or name. It would be much more intelligible to outsiders, when it comes to be read.

Mr. McAree—Where the Crawford Mills failed, is that free milling ore?

Mr. Sewell—Mostly free milling. They ceased to be free milling when they got down. I don't think there is any really refractory ore except this Pine Portage.

Mr. Tyrrell—None of the mines worked there are mispickel, are they? I know it occurs there in large quantities.

Mr. Sewell—No, I don't think so. It is chiefly in quartz.

Mr. McAree—Do you know if the mispickel carries much gold?

Mr. Sewell—Well, some of it does.

Mr. Whitson—Any specimens of coal I ever heard of up there were in the hands of Indians, but whether they came from the tugs on the lake, or not, I would not like to say. The general impression up there is that they came from that source.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

"ANNUITIES."

BY M. J. BUTLER,

O.L.S., C.E., Napanee.

IN anticipation of possible criticism that this subject has nothing to do with "Surveying," it may be answered that now-a-days surveyors are assumed to be men of high technical acquirements, that they are frequently consulted by school trustees, municipal officers, and others with reference to "sinking funds," "realized prices" for debentures, etc., a class of problems that really belong to the profession of an actuary. It is therefore thought that an easily applied solution to this class of problems will be of sufficient interest and value to merit a place in the Proceedings of the Association.

Frequently the expediency of temporary construction is condemned. The expression is common "It would have been cheaper in the end to have had it done right in the beginning." Now, when called upon to carry out any works, we should be able to show clearly where the "temporary"—*vs.* the "permanent"—is warranted; and, in so doing, we should bear in mind that the rate of interest is steadily declining, that new methods of construction cheapen cost, and that in this progressive age new inventions are constantly superseding the old methods and materials, abstract mathematical formula being more difficult to follow, only concrete examples embodying the rule will be used in what follows:

We are anxious to provide for our old age, and the experience of those who have grown rich teaches us that there is but one safe way, viz., the accumulation of small sums yearly, invested at compound interest. Hence we will find how much a saving of $200.00 a year for 20 years at 5% per annum compound interest will amount to?

The formula is $A = \frac{P(R^t - 1)}{r}$ where A = amount sought.

P = periodic payment, in this case $200 per year.
R = $1.00 improved at the rate r for 1 year, in this case = $1.05.
t = time, in this case, 20 years.
r = rate per cent. in this case, .05.

Log 1.05 = 0.0211893 × 20 years = 0.4237860, and this is the logarithm of 2.6533 − 1 $\frac{1.6533}{.05} = 33.066 \times \$200 = \$6613.20$. Quite a comfortable little sum.

A new high school is to be built to cost $30,000.00. It is proposed to raise the money by debentures, to run 20 years, drawing interest at the rate of 5% per annum. What should be the annual sum raised?

The formula is $A = \frac{PR^t r}{R^t - 1}$

Where A = periodic payment required.
P = present value of the periodic payments, in this case = \$30,000.
R = \$1 improved at rate, r, = 1.05 in this case.
r = rate per cent .05.
t = time = 20 years.

$$\frac{\$30,000 \times \text{Log } 1.05 = 0.0211893 \times 20 \text{ years} = 0.4237860 = 2.6533 \times 05 = .132665}{2.65533 - 1 = 1.6533}$$

$= .0802 \times \$30,000 = , \$2406$, *Q.E.D.*

A corporation issues debentures at the par value of \$50,000 bearing 5% interest, running 10 years, and receives therefor \$46,000. What rate of interest does the loan actually cost? For the \$46,000 received they pay \$2,500 a year = .0543, at the end of 10 years they must return \$4,000 more than they received. The amount of \$1 per year at 5% for 10 years is 12.5786, hence we have the proportion \$1 : 12.5786 : : x : \$4,000 = \$318, which paid at the end of each year produces \$4,000 at the end of 10 years. And \$318 is .0066 per cent. of \$46,000, which added to .0543 = .0609% *Q.E.D.*

A proposed new pavement with an estimated life of 30 years will cost \$3 a square yard, whereas the town being poor finds that a wooden one will cost \$1 per square yard with an estimated life of ten years. Interest being 5% per annum. Which is the better investment?

The solution of this problem is as follows:

1st. $\$3 \times (1.05)^{30} = \$12,9658\phi$.
2nd. $\$1 \times (1.05)^{10} \div 2 \times (105)^{10} + \$3(1.05)^{10} = \$9.77\frac{1}{3}$.

Or by an annuity table we find at once the annual cost, viz.:

The Permanent, $\$3 \times .0651 = 19\frac{1}{2}$c.
The Wooden, $1 \times .1295 = 12\frac{95}{100}$c.

In conclusion the writer desires to express the opinion that life is too short to spend the necessary time to work out the formulæ by Logarithms. Books, such as Millener's "Useful Tables for Business Men," published by Rand, McNally & Co., of Chicago, can be had for \$1 25, and by their aid this class of problems becomes merely simple multiplication.

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THE GENESIS AND DEVELOPMENT OF MINING IN THE SUDBURY DISTRICT.

By JOHN D. EVANS,

O.L.S , C.E., Trenton.

THERE have been heretofore many reports and papers presented from time to time on nickel mining of this (Sudbury) district, all bearing more or less of a professional or technical character, fully describing the rock formations, but very few touching upon its early history. The writer having been connected more or less with the industry, almost from its inception, purposes to give, in the following paper, a brief account drawn chiefly from his personal recollections and observations.

Previous to the advent of the Canadian Pacific Railway in this district (in the year 1883), this section of the country was in a state of nature, untrodden by the foot of white men, except perhaps in the case of the officers of the Hudson Bay Company and the staff of the Geological Survey of Canada, whose travels were confined more to the vicinity of the lakes and streams, and little if anything was known of the numerous and immense deposits of mineral throughout this region.

The face of the country generally is more or less undulating, broken at intervals with rocky ridges and hills, with swamps and marshes interspersed, and was covered chiefly with a heavy growth of green timber, white pine prevailing over large areas, mixed with hemlock, birch, etc.

At various times, and many years previous to the year above mentioned (1883), large areas of this section had been devastated by forest fires, thereby destroying the moss and other vegetation on the rocky ridges and hills, which in after years presented a desolate appearance, with numberless tall, nude trunks of the pine forest trees, interspersed amongst a thick growth of young trees, consisting chiefly of poplar, white birch, etc , and with areas of bare rock cropping out in many places, thus exposing small or large patches or tracts of a reddish brown decomposing rock or gossan, and in some places a reddish earthy soil, almost a sure indication of mineral underlying Such was the appearance of the country when the line of the Canada Pacific Railway was projected through this district. The first indications of the presence of mineral were had during the construction of the railway, first in a cutting through the extreme easterly end of a small ridge on the line of the main line, about four miles north westerly from Sudbury, since known as the "Murray Mine," and second, a very small show of mineral in a very insignificant cutting (and appearing only in the centre of the track) on the line of the "Soo" branch of the railway, about twenty-five miles south-westerly from Sudbury. This property was first known as the "Crane Mine," and subsequently the "Worthington Mine," under which name it is now being operated. Surface indications of the presence of mineral, although much broken by wide intervals, could be traced from this point for several hundred feet in a north-easterly direction across a small stream and up on to a ridge. This property was bonded by some New York people, who prospected the place under the charge of a mining expert from New York during the summer of 1885, had a number of men employed and put down a shaft on the top of the ridge, about sixty feet deep. Small quantities of copper ore (chalcopyrite) were obtained, but not sufficient to promise a paying mine, and finally was given up.

During this year (1885) prospecting was carried on in this section by a few pioneers, among them being Thomas Frood, R. McConnell and James Stobie. The first mentioned (Frood) had discovered several promising properties and had associated with himself Messrs. McAllister and Medcalf, of Pembroke, and commenced to develop a promising find on lot one, concession three, township of Snider, and known as the "McAllister Mine." A shaft about ten feet deep was sunk and the prospects were promising for a paying copper mine. The surface indications at this point were very extensive, extending continuously for several hundred feet in a south-westerly direction up the slope of a high hill, and at places upward of 200 feet wide. Subsequently, in September 1886, this property was visited by Lady Macdonald in company with a party of influential gentlemen from Montreal and other places, among whom might be mentioned W. C. Van Horne, Esq., Sir Geo. Stephen and Sir Charles Tupper. Saddle horses were provided for the trip of two miles from Copper Cliff for some of the gentlemen, but there being no side-saddle obtainable, her ladyship undertook the walk, which under the circumstances was a trying one, the road being little more than a bridle trail. The weather was exceedingly close and sultry after a heavy thunder-storm in the early morning, which had filled every small depression in the trail with water. The heat over head and the mud and water under foot rendered pedestrian exercise anything but exhilarating, but her ladyship showed great pluck and took everything in good part, and in honor of the event the name of the mine was changed to that of "Lady Macdonald Mine." In addition to the above mentioned discoveries prospecting had been done at other points, the most notable being by Thos. Frood and associates on lot six, in concession six, township of McKim, and by R. McConnell, on lot one, concession four, township of Snider. Up to this time (the end of the season of 1885) nothing had been done, excepting some prospecting in the most primitive manner at various points, and copper was the only mineral of commercial value at that time known to be contained in the rock formations.

At this stage Mr. S. J. Ritchie, of Akron, Ohio, visited this section, and after careful inspection negotiated for several properties, and during the winter of 1885-6 the Canadian Copper Co. was formed to take over and operate said properties, among which were the McAllister (now Lady Macdonald) mine, McConnell mine, lot 12, concession 2, township of McKim (now Copper Cliff Mine), lot 6, concession 6, township of McKim, and lot 1, concession 1, township of Creighton.

Late in the season of 1885 the deposit of mineral on S. half lot 1, concession 1, township of Snider, was also discovered by one F. J. Eyre and his associates, and a few shots put in. Some samples were procured from this place by the writer in November of that year and submitted to Mr. Ritchie. This property was eventually purchased the following year by the Canadian Copper Company, and the mine is now known as the " Evans mine." It was also during this season that the Stobie mine, on lot 5, concession 1, township of Blezard, was discovered by James Stobie, some superficial prospecting done by cutting a trench up the easterly face of the hill from the bottom to the top for upwards of 100 feet in length, to a depth of from eighteen inches to three feet, through a reddish sandy soil, overlying the gossan and piercing the gossan in places to the underlying mineral. This mine was also secured by the company in the summer of 1886, and a railroad projected to it from Sudbury, which was put under construction before winter set in, the distance being four miles.

With the opening of the spring of 1886 active measures were taken by the Canadian Copper Co. for prosecuting the development of the several properties on an extensive scale. Work was first commenced at the twin hills, on lot 12, concession 2, township of McKim, and known as " The Buttes," since named " Copper Cliff Mine," by making a side hill open cut through a sand and gravel formation, the decomposed rock or gossan cropping out at the apex of the hill. Ore was struck so soon as this gravel and sand had been passed through, which proved to be largely composed of magnetic iron pyrites (pyrrhotite) with small masses and particles of chalcopyrite scattered throughout it. At this time the presence of nickel in the pyrrhotite was not suspected, and since this mineral was known to possess no other value, large quantities were consequently thrown over the dump and now form in part the dock between the mine shaft and the railroad tracks. A railroad track was constructed to the mine from the " Soo " branch of the Canadian Pacific Railway in the month of September, the distance being exactly one mile ; and in the month of October a shipment of several hundred tons of selected copper ore was made to New York, upon the treating of which the discovery was made of the presence of nickel.

During this summer (1886), prospecting work was continued at the McAllister mine to a limited extent, also at the McConnell mine, and the Eyre (now Evans) mine was purchased by the Canadian Copper Company and the sinking of a shaft commenced. It was also during this summer (1886) that R. McConnell discovered the deposits of mineral upon the S. half of lots 2, 3, 4, 6, 8 and 9, concession 5, and N. halves lots 8, 11 and 12, concession 4, township of Denison, some of which also came by purchase into the possession of the Canadian Copper Company in 1888. In October of this year (1886) was also purchased by the same company, the S. half of lot 7, concession 6, township of McKim (lying adjacent to a lot (No. 6) formerly purchased by them), from Thos. Frood and associates P. C. Campbell and Robert Tough, for the sum of $30,000; this being by far the largest figure paid up to this time for mineral lands in this section. During the year 1887 mining was carried on in a very desultory manner, owing largely to the want of a practical method of treating the ores containing nickel, and during this term very few further discoveries of mineral deposits of any appreciable extent were made. In the winter of 1887-8 the services of Dr. E. D. Peters, jr., were called in by the Canadian Copper Company to devise some method of successfully treating the ores, which culminated in the plant which was installed during the following season of 1888 at Copper Cliff, consisting of an extensive roasting yard furnished with two railroad tracks, an elevated and a low-level one, a 100 ton Herreshoff smelting furnace, with blowing engine, pumps, steam boilers and other accessories. This furnace was blown in about the latter part of December of that year and proved very successful in treating the ores. This plant was augmented by a second furnace, of a like description and capacity, early the following summer (1889).

It was during this year (1888) that a railway track was constructed from the "Soo" branch of the Canadian Pacific Railway to the Evans mine, a distance of about 3,000 feet, and active operations were undertaken in bringing the ores by rail from the three mines operated by this company, viz: Copper Cliff, Evans and Stobie to the roasting yards, constructed in the vicinity of Copper Cliff mine. The characters of these ores were somewhat different, and each had a distinctive feature of its own. That of Copper Cliff, while carrying a higher percentage of copper and nickel than either of the other two, was yet more disseminated through the matrix or vein rock (diorite), and the chalcopyrite and pyrrholite more intimately and regularly mixed and carrying about an equal percentage of each metal, varying from five to six per cent., while individual samples of pyrrhotite would assay as high as ten or twelve per cent. of nickel. With the Stobie ore the mineral occurred in large solid masses of pyrrhotite, very free from barren rock and with a much smaller proportion of chalcopyrite, but assaying on an average very little over two per cent. of each metal (Cu. and Ni.); while the ore from the Evans mine bore a character between these two, in that the bunches or masses of Cu. and Ni. ores were more clearly defined and separated as a rule, and the ore carrying from three to four per cent. of each metal. The ores from either the Copper Cliff or Evans mines, or from both combined, used as a charge for the furnace, was too silicious, but with a proper proportion of the Stobie ore, carrying an excess of iron, added, made a suitable combination and giving self-fluxing ores. These mining and smelting operations have been continued with short interruptions up to the present date, with the exception of the Stobie mine, which has been closed down owing to the ores from the other two mines being recently of a higher grade, and closer sorting gives a grade of ore which can be smelted successfully without calling in the aid of the Stobie ore.

It was not until the season of 1889 that other mining and smelting companies entered the field, the first one being the Dominion Mineral Company, which developed the Blezard mine, which had been discovered late in the summer of the previous year (1888) ; this mine being distant about one and one-fourth miles northerly from the Stobie mine. It is now, however, closed down, as the ore is said to be entirely worked out. This company (Dominion Mineral Company) also, about the same time, secured the Crane mine (now known as the Worthington mine), and have prosecuted mining operations intermittingly and with varying results, smelting the ore therefrom at their smelting furnace at the Blezard mine.

The same year (1889) the Murray mine was secured by the Messrs. H. H. Vivian Company of Swansea, Wales, and in due course, after a certain amount of prospecting had been done, a mining and smelting plant was installed, at which operations have been continued with short interruptions to this date.

In the year 1887 gold was discovered upon lot No. 6, concession 4, township of Denison. A company was formed to prosecute mining upon this property and other lots in the vicinity, and was designated the Vermillion Mining Company. The vein carrying gold did not extend, however, to any great depth and operations were soon afterward suspended, but at another point upon the same lot Cu. Ni. ore has been found of a very high grade, assaying seventeen per cent. of Ni., on an average for several car loads. With this ore was also associated sperrylite, an arsenide of platinum (this being the first instance where platinum has ever been found as an ore), which occurred in the sand contained in the crevices of the rock in the vicinity of a shaft that had been sunk. In the year 1890 this mining company passed under the control of the Canadian Copper Company, since which time mining operations have been entirely suspended.

Since the spring of 1890 many deposits of nickel ore have been discovered throughout the district, of greater or less extent, some presumably of great value, but the great majority probably of little or no value. Many companies have been formed to develop mineral lands, but very little has been done in the way of prosecuting mining operations vigorously. There are two, possibly three, exceptions, viz. : The Creighton Gold Mining Company, operating a claim in the 4th and 5th concessions of Creighton, but with the details of which the writer is not personally conversant ; the Inez mine in the township of Drury, which has been worked a couple of years, has a mining and smelting plant, but has not to this date been very productive ; the Davis mine in the township of Blezard, after some prospecting work done in 1891 and '92, installed a good mining plant in 1892, but has since doing so closed down.

For a full description of this district in all its scientific bearings, geologically, mineralogically and metallurgically, I would refer you to a report by Dr. Robert Bell, of the Geological Survey Department of 1891, and a paper by Alfred E. Barlow, M.A., of the same department, read before the Logan Club of Ottawa, on 6th March, 1891.

DISCUSSION.

Mr. Gaviller—This is a most interesting paper. It is the clearest description I have ever heard of that part of the country. I saw a very extraordinary description in the *Globe* the other day of how the nickel was discovered in those ores. It seems to have been found by accident as it were, having been sent to New York for smelting. Some six or seven careful assays had been made of the ore and the presence of nickel had not been detected. It seems to me very strange how it was that they did not find it out.

Mr. Evans—The nickel present in the ores is a very small percentage, comparatively speaking, and unless a search is made for it, (and it is a very intricate assay to make,) it is apt to remain unnoticed. In those days very few assayers knew how to make an assay for nickel. Even the assayer of the Canadian Copper Company had been there for some time before he noticed it. Take an ordinary piece of ore and it would not run above two or three or four per cent., which is a very small percentage, and unless some one made a special examination for it they would not find it. Where a sample of copper ore would probably be thirty-five per cent., a sample of nickel ore would be only about three or four.

Mr. McAree—Have they ever made use of the magnetic needle in exploring?

Mr. Evans—The needle is always affected by it, but we never use it particularly. There are many deposits of pyrrhotite which would only carry one-quarter to one-half per cent., and it would be just as much magnetic as what would carry fifteen per cent. It runs all the way from a mere trace of nickel up to thirty per cent., and in every case it would be still magnetic.

Mr. Kirkpatrick—Is there much ore being shipped now?

Mr. Evans—They are shipping the matte all the time. The Canadian Copper Company ship to New York.

Mr. Chipman—In correspondence with the members of the committee respecting Topographical Surveying I received a letter from a member in Algoma, in which he says "The Mining Act has knocked the surveyors up this way completely out." Now, I had the privilege of visiting the Copper Cliff and other mines in the vicinity of Sudbury last year, and discussed the question with several parties there, but I have not been sufficiently enlightened yet to know in what respect the present Mining Act has knocked the surveyors' business out.

Mr. Niven—There is not so much speculation. I had a conversation with a surveyor last fall at Port Arthur, and he said that during the old Mining Act, before the present Act was passed, a great many prospectors took up land whether there was anything on it or not, so long as there was rock there of Huronian formation. They would take up tracts of land, have them surveyed, and buy them at $1 an acre. This was going on all through the district, and the result was that the Government was receiving a great amount of money for lands, but since the Mining Act has been passed there is very little of that done. The consequence is there is no surveying being done, and it does not seem that the Government is realizing much money from the sale of land. I suppose that is what the surveyor meant by saying that the Mining Act has knocked the surveyors out.

Mr. Chipman—The Mining Act as it stands now will not permit any individual to buy land at $1 an acre.

Mr. Kirkpatrick—No, it is $3 within 12 miles of the railway and $2.50 outside.

Mr. Evans—I think the royalty claim is one of the great bugbears.

The President—There was at one time a report that gold had been found at Copper Cliff.

Mr. Evans—There is just a very slight trace. There are also platinum and other minerals and a slight trace of cobalt.

The President—There was a report circulated that the reason there has not been more work done in nickel was on account of there not being a demand for the nickel. Is that the case ?

Mr. Evans—I cannot of course answer that, but what the company gave out is, that they have not got a market for the nickel. The proportion of nickel used in nickel steel is only about three per cent. The great difficulty is that the processes at present known are expensive.

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PELEE ISLAND DRAINAGE WORKS.

By WILLIAM NEWMAN,

O.L.S., C.E., Windsor.

THE writer will, in his humble way, try to convey to his fellow-surveyors some of what he considers the most important points in a drainage system, together with the description of some of the works on which the writer has been employed.

Drainage works have been carried out to a larger extent in Western Ontario than in any other part of the Province. This can be accounted for by the fact that in few parts of Ontario is the soil so productive as in the Western part, and in no part is the general surface of the soil so nearly uniform and level.

The streams in the West are generally small, with very low banks and slow currents.

Under the Counties of Essex and Kent the rock formation is what is known as the Corniferous formation, cropping out in the Township of Malden, near Amherstburg, and on Pelee Island. But in the remaining part of Essex and Kent it is covered with a deposit of blue clay, sand, and gravel, to an average of more than 100 feet in depth. Wherever the rock crops out, it shows unmistakable signs of having been planed off and groved by the glaciers. This glacial action is very plainly marked on the east side of Pelee Island.

Lake St. Clair lies to the north of the County of Essex and west of the County of Kent. Lake St. Clair, as is well known, is very shallow and bounded on all sides by great wide marshes. Into, and through these marshes, nearly all waters from the Counties of Essex and Kent flow. This low lying marsh land is generally composed of clay mixed with a certain amount of vegetable matter, and also covered with vegetable matter varying from about six inches to three or four feet in depth.

In many places, when the water is high in the lakes, this marsh land is inundated for miles in extent, and as this water is spread over the marsh the greater portion of the year, it keeps the land, where the vegetable matter is deep, almost afloat, and by this means makes the marsh very soft and boggy.

Thousands of acres of this marsh land have been bought for two dollars per acre and upwards, and to a casual observer it would appear as a wild speculation.

Vast tracts of these marsh lands have been reclaimed and are to-day under cultivation, and make the best farming land that can be found, when the water is kept off, after the muck has had a chance to rot for two or three years.

Some six or seven years ago an attempt was made to drain, what is known as the " Big Marsh " on Pelee Island, and expel the water by steam power into Lake Erie.

The Big Marsh is situated, as can be seen from the accompanying plan, in the northern part of the Island. The total area of the Island is about 13,000 acres, and the area of the " Big Marsh " basin about 7,000 acres, and of this 7,000 acres more than 5,000 acres is a treeless marsh. The remaining 2,000 acres being what is known as wet wood-land, and high land, the waters of which drain into the Big Marsh. The whole of this marsh land was bought up some years ago by two gentlemen—L. S. Brown, who lives on the Island, and Dr. J. M. Scudder, of Cincinnati, Ohio. An attempt was made some years ago to have the whole marsh reclaimed and divided up into farms. To carry out this scheme the owners, Messrs. Brown and Scudder, let the contract to the Chatham Dredging Company to construct about thirteen miles of drainage canals and to form dykes along the lake where there was any danger of the lake surf coming over the natural bank during the heavy blows.

The dredging was proceeded with, but during the greater portion of the time that the dredge was at work there was from one to two feet of water on the marsh, which was sufficient to keep the vegetable matter afloat, or at least very soft and boggy, so that when the dredge went through it left a lot of this muck behind, which settled to the the bottom. When the dredging was completed, a steam boiler and engine and one of those great fan-like water-wheels were put in position at the north end of the Island, at the point marked "Old Pump House. These big wheels are built principally of wood. This particular one is about twenty-eight feet in diameter, and about six feet wide on the face, and built into a closely fitting trench or sluice. The wheel is made to revolve in this sluice by means of a pinion working into segments on the centre of the outer surface of the wheel, and by this means causes the water to be shoved out in front of the great fanlike spokes.

This kind of wheel seems to work fairly well where the maximum lift is only a few feet, and even then it is a great waste of power caused by the wheel never fitting closely to the sides of the sluice, and by this means allowing a good share of the water to be continually falling back around the fans. There being only one of these wheels to pump the water off 7,000 acres of land, was, in the writer's opinion, assuming the capacity of the pump to be far too great, then by placing it at an end of the system of shallow canals, and supposing it to drain the whole thireen miles, was out of the question. One of the greatest advantages gained by the partial drainage of this marsh land was that as the water was lowered in the canals the land settled and became solid, and the muck commenced to rot. But what muck was left by the dredge in the canals settled to the bottom, this giving rise to a rank growth of aquatic plants which, in places, was almost sufficient to stop the flow of water in the canals, and during wet weather the marsh land was altogether too wet for farming purposes. Such was the condition of affairs when the Council took over the drainage of the marsh and undertook to improve it under the Municipal Drainage Act, in the summer of 1892, and engaged the writer to come over and advise a scheme to improve their drainage works.

The writer made a close survey of the whole marsh, taking levels every 100 hundred feet along the entire length of the canal system, also noting the distance between the stakes, and the surface of the water in the canals. Then soundings were taken opposite every stake. By this means the depth of the old canals was determined, together with the surface of the marsh.

The writer's plan included the cleaning out of about eleven miles of the old canals, to a depth of about eight feet from the surface of the marsh, and at the time making the top of the canal at least thirty feet wide, with the bottom as narrow as it was possible for the dredge to pass through. Also the cutting of a channel six feet wide and about four feet deep through the rock at the place called the "Neck," shown on the accompanying map, so as to give an outlet to the waters of the round marsh. Together with the erection of two new pumping stations, one on the east, and the other on the west, side of the island. In each pump house was placed a steel boiler fourteen feet long and sixty inches in diameter, connected to an engine with cylinder fourteen inches in diameter, and giving an eighteen inch stroke, making one hundred and fifty revolutions per minute, with a boiler pressure of eighty pounds per square inch. To each engine is coupled by means of a rubber belt sixteen inches in width a centrifugal pump. The pump is of the horizontal type with a *suction* pipe *twenty inches* in diameter, and the *discharge* pipe *eighteen inches* in diameter. The maximum lift is ten feet. Each pump is connected to the canal by means of a flume six feet wide and nine feet deep, built of white oak timber and planked both inside and outside with white oak planks. The discharge pipe is connected with the lake by means of another flume.

The contract for the whole of this was let in November, 1892, to Alister McKay, Esq., of Chatham. Work on the canals was commenced at once, and carried on till about the 1st of January, 1893, when the dredge was compelled to shut down owing to the heavy ice forming in the old canals. Work was not started again until some time in March, 1893, and was again pushed forward as fast as the nature of the work would permit, without any serious delays, excepting once or twice, when the machinery of the dredge gave out. When the spring opened the machinery and materials were brought upon the grounds, and the work of erecting the pumping stations and the placing of the machinery was proceeded with. On about the first day of November last, the dredge made its way out into the lake, and the pumping machinery was started, and ran very smoothly, to the great satisfaction of the writer, and all the ratepayers present. Now all the work that remains undone is the blasting of the rock at the "Neck," which could not be proceeded with until the pumping machinery was started, and the water lowered in the canals.

The estimated cost of the whole of the above work was $22,500, but up to date only about $21,000 has been paid, leaving a balance of $1,500 to finish the rock blasting.

The pumps, since they have been in operation, have given the utmost satisfaction, and are keeping the water down in the marsh with the greatest possible ease.

The writer's reason for placing a pump at each side of the Island and leaving the old one still in use at the north end was to give the water a chance to get to the pumps without having to travel so many miles of canals, for it must be borne in mind that the surface of the marsh is almost a horizontal plane, and whatever fall the water has in the canals it is caused by the lowering of the water at the "pump" end of the canal. But when it comes to dividing this fall over five or six miles of canals, partly choked with vegetation, you can easily see the writer's reasons for having the pumping machinery distributed as much as possible.

There are a number of marshes, in this section of the country, where reclamation may be carried on to a large extent and be very successful There are marshes again where it would be a total failure.

The most essential points to be considered in determining whether it would be advisable or not to try to reclaim a certain marsh can only be determined by a careful survey and examination of the whole surroundings, as to the nature of the muck on the top, as to the depth to which water lies on the marsh, of what the sub-soil is composed, and if there is any quicksand in the same. Also look up the size of the marsh, and the nature of the body of water around it, whether it is a river or a lake, or whether or not it is subjected to floods. Still another consideration which is of great importance is, the price of farm land in the adjacent locality, both present and prospective. If there is much muck on the surface of the marsh, and the subsoil is composed of quicksand or gravel, it is doubtful whether it would pay to try to embank, or reclaim the marsh. But where the muck is not too deep, and where the subsoil is of a clayey nature, and not subjected to floods, the marsh can be easily reclaimed and converted into the best of farming land. The only question then arises, will the nature of the land in the neighborhood warrant the expense of the undertaking?

A large tract of good marsh should be reclaimed for from six to eight dollars per acre. This first cost will include the dredging and the placing in position of the necessary pumping machinery.

The yearly cost of keeping the machinery in order, and the hire of a man to run the same during the wet weather, together with the cost of fuel, should not amount to more than twenty cents per acre per year. The contract for running the machinery of Pelee Island, together with supplying all the fuel necessary to pump the water off the whole 5,000 acres of marsh, has been let for the year 1894 to a reliable man for $900.

Windmills have been tried as a power to pump the water out of our smaller marshes, but in no case that has come under the writer's notice, has wind, as a power for pumping water for drainage purposes, proved successful.

There are a great many swamps and marshy places far inland from our large lakes and rivers that can be drained by merely cutting a channel through a ledge of rock, or through a bar of earth, and by this means give the water a chance to flow out by gravity ; thus converting, what would appear as a barren waste, into first-class farming lands, at a very low first cost, and then there would be no further costs for pumping, etc.

The writer was employed on one of these drainage systems, some time ago, where there was a treeless marsh, and covered with water the greater portion of the year. The plan adopted to drain this marsh was to commence back at a creek about three miles from the nearest edge of the marsh and to bring up a ditch, on a grade of about three feet per mile, and carry this ditch clear through the marsh. This ditch was at places over twelve feet deep, and the bottom width the whole way up was twelve feet. Since this work has been completed what used to be a watery waste is now the most productive section of the township.

So much for the financial side of the question ; but, perhaps, what engineers should consider more than the financial side is the effect of good drainage, and the removal of all stagnant water and decaying vegetable matter from the community, as is now well-known the health of a community is known by their surroundings, and the health of a man, to a great extent, depends on whether or not he is supplied with the following :—Pure water, pure air, and pure food. Now there is nothing that will give a community pure water and pure air so effectively as good drainage, and if a man has pure water and pure air his food will be much purer than it is possible for it to be without these elements. As a proof of this I would direct your attention to the amount of ague, chill fever, etc., there used to be in the Counties of Essex and Kent before municipal drainage was commenced, and to-day you never hear of a case of any of these low forms of fever.

Thus by assisting nature and giving her law a chance to act, the engineer has brought health, wealth and prosperity to his fellow-citizens in this as well as in many branches of science.

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THE GRAND BEND CUT.

BY R. COAD,

O.L.S., C.E., Glencoe.

GRAND BEND, as referred to in the subject of this paper, is the name given to a small country corner near the extreme northerly angle of the County of Lambton, and is no doubt applied to it on account of the sharp bend which takes place in the Aux Sables River at this place.

The Grand Bend Cut, the subject of this paper, is a work which has recently been carried out (but not yet completed) of making a cut or channel from the river at the Bend, direct to Lake Huron, and of deepening the river up stream above the Bend for a distance of about three and a half miles.

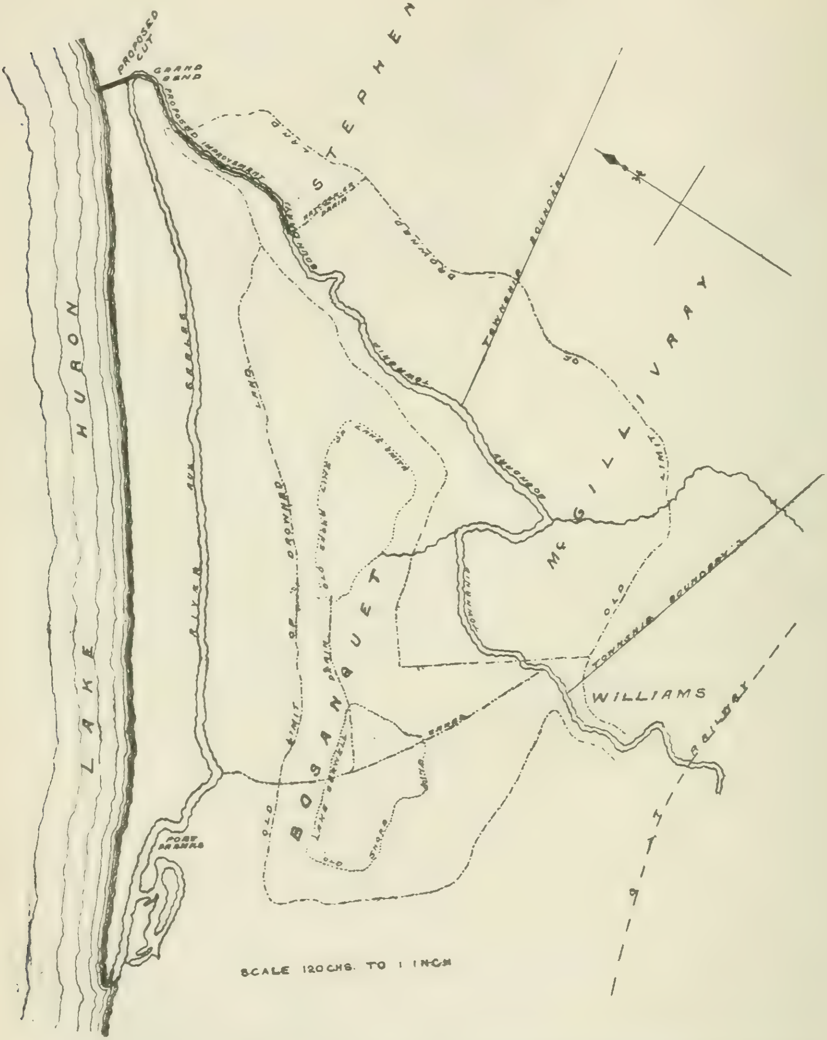
Taking its rise in the Township of Hibbert, in the County of Perth, the River Aux Sables finds its way by a crooked course some seventy miles long, through parts of the Counties of Huron, Middlesex and Lambton to its outlet into Lake Huron at a point some thirty-five miles in a staight line from its source and about an equal distance north east of Sarnia. There is little doubt but that at a comparatively recent geological period the mouth of the river was some twenty-four miles above its present location, near where the course of the stream crosses the boundary between the Townships of Williams and McGillivray in the County of Middlesex; and that at a still more recent period the outlet into the lake was at Grand Bend, from which latter point, by a process still going on, the winds and waves are shifting the outlet farther south-westerly each year.

The prevailing winds in this locality are from the north-west across Lake Huron, and acting on the lake-shore sand are continuously shifting it into the outlet of the river and throwing it up to form the sand dunes of the peninsula extending from Grand Bend to the present outlet of the river, a distance of about twelve miles.

This peninsula varies in width from one-half to one-quarter of a mile.

Previous to, and during the time that the outlet of the river was at Grand Bend, all that part of the Township of Bosanquet, lying northerly of the north boundary of the Township of Williams, and westerly portions of the Townships of McGillivray and Stephen, were flooded by the waters of the river, the lake shore being at that time the sand banks east of the present channel of the river from Grand Bend to the existing outlet.

On the area thus flooded the silt brought down by the river was deposited, forming a soil from which a luxuriant vegetation sprang up, converting the whole tract into more or less solid land, with the exception of about 2,200 acres, occupied by Lakes Burwell, Smith and George.



The Canada Company originally owned all the land in the Townships adjoining this tract, and from time to time sold the lands in the neighborhood until all that not flooded had been disposed of.

This brought up the question of how best to drain the drowned land, and land which was subject to flooding.

To accomplish the first of these objects and to aid in preventing the second, the Canada Company, acting on the advice of their then engineer (now commissioner) Mr. Willson, let a contract in the winter of 1872, to construct a new channel for the river, commencing at a point on the river about one-half mile below the north boundary of Williams, and running thence north-westerly, nearly in a straight line, passing through Lake Burwell to join the river again about two miles above the present outlet.

This channel is about one and a half miles in length east of Lake Burwell, about one mile through Lake Burwell and one and one-fourth miles west of Lake Burwell; in all, a total length of about three and three-fourth miles.

The bottom width of the new channel was twenty feet throughout and the side slopes one and one-half to one. The section west of Lake Burwell averaged about thirty feet in depth (the maximum depth being sixty feet) through pure lake shore sand and gravel; through the lake the excavation was vegetable matter, while the section east of Lake Burwell averaged about six feet through clay and vegetable matter. This contract was completed in the fall of 1875, and subsequently about ten miles of tap drains were constructed.

The cost of the work done by the Canada Company was about $80,000, benefiting about 16,000 acres of land.

The original scheme contemplated the construction of the cut at Grand Bend, but it was not considered advisable to proceed with this part of the work until the resident ratepayers who would be benefited should apply to have their lands drained under the provisions of the Municipal Act, and so this part of the scheme lay untouched until the year 1887, when a petition having been sufficiently signed and presented to the Municipal Council of the Township of Stephen, that body instructed the writer to make the necessary examination, survey, plans, and report for the drainage required.

The report states that the locality described could be most effectually drained by constructing a drain in Haycock creek, and carrying the water into the Aux Sables River. and thence along that course easterly to the Grand Bend, and thence across the bar into Lake Huron.

It was found that the surface of the water in Lake Huron was five feet seven inches lower than the surface of the water in the river at the Grand Bend, at the time of low water, and that in one and one-fourth miles up stream from this point was a rise of two and one-half inches in the surface, above this it was practically level for the next three miles or more.

The distance from the lake to the river on the course of the cut is twenty-one and one-half chains, which was staked off and levelled in the usual way. Soundings or measurements were also taken in the bed of the river along the course of the proposed work, and numbered stakes planted on the shore as was deemed necessary. As the height of water in Lake Huron is somewhat variable, it was thought advisable to make the bottom of the cut one foot lower than the surface of the lake at the time of survey.

The greatest depth of cutting in doing this was thirty-one feet nine inches, and the shallowest, twelve feet eight inches, or an average of about twenty feet for eighty rods.

The bed of the river from the head of the cut is very irregular, as shown on the profile, for a distance up stream of about one and three-eighths miles, the water varying in depth from one foot to eight feet; above this the bed is more regular and the water from three to six feet deep to where the work leaves the river, and above this again for four miles or more the water in the river is seven or more feet deep. The bottom of the cut and work in the river was to have a level grade throughout, and was to be thirty feet wide and the side slopes one and one-half feet horizontal to one vertical.

By such a scheme as this it was thought that the water in the river would be discharged so quickly at times of freshet that the adjoining lands would not be flooded to any considerable extent, and that at ordinary times the water in the river would stand about five feet lower than it had previously done, and thus an additional five feet or so of drainage would also be obtained and the lands on either side, much of which was, before the performance of the work, from two to eight feet above low water in the river, would be largely benefited as far up stream as where the original cut was made by the Canada Company.

It was also thought that from the nature of the bank or bar to be cut through to the lake that the channel would widen to a considerable extent by the action of the water from the river, and also that the mouth of the new channel might become obstructed to some extent by the lake casting up sand bars across it, but this would be scoured out some at times of freshet in the river and that the channel would thus keep tolerably well open.

The estimated cost of the work was as follows :—

Excavating in the cut, 61,500 cubic yards at 15c..............	$ 9,225 00
Excavating in the river, 47,574 cubic yards at 23c............	10,942 02
Excavating in Haycock Creek, 3,721 cubic yards at 10¾c... ..	400 00
Total cost of excavation........................	$20,567 02
Other expenses in connection with the work.................	900 00
Total....................................	$21,467 02

This sum was assessed over 8,114 acres of land, not including road allowances, also on the road allowances to the extent of $1 010.

The assessment on the lands varied from 80 cents per acre to $4.15 per acre, or an average of about $2.52 per acre, involving lands in four townships and three counties. Some little difficulty was experienced in getting the necessary By-laws passed and money raised, and some of the weak points in the Ontario Drainage Act were made conspicuous, as shown in the suit, Stephens vs. McGillivray. Notwithstanding this, the preliminary part of the work was satisfactorily settled and the contract let, and actual work commenced in the cut in the summer of 1892. It was found that the water in Lake Huron at this time was about three feet lower than at the time of survey in 1887. This facilitated, to some extent, the work of the cut. The top of the cut was taken out by means of teams and scrapers, and the lower part by means of a tram road and dump cars, filled by hand and operated by horses, carrying the excavated material and dumping it into the lake. In this way probably about one half of the work next the lake was almost completed. In that part next the river a narrower channel was cut through to a depth below the surface of the river and the water of the river turned through it. The action of the water of itself now nearly completed the work so far as this cut was concerned, carrying the material out into the lake ; so that by the following spring, the narrowest part of the channel would not be less than 300 feet and varying to 600 feet.

As was also supposed, a bar is already cast up at the mouth by the action of the waves, and a formation started on the north and west sides, similar to the one cut through. The bar on excavation was found to be pure lake shore sand and gravel, coarser towards the bottom where were many stones from two to four inches in diameter, except for some two or three chains next the river where the bottom was made up of a marly clay in which trees, logs, stumps and the like were found.

The work in the river was not commenced till the following spring (1893), when a dredge was put in, working its way from the lake up through the cut. The bottom of the river through the the heavier parts of the work towards the Grand Bend and also towards upper end was a very hard white clay, containing stones and boulders, and somewhat difficult to operate a dredge in. Farther up the river and in the lighter parts of the work, the bed is softer and of a mucky nature. This part contained the remains of many trees, stumps, etc., in a good state of preservation, which had, no doubt, floated down from farther up stream and become lodged and buried in the channel at the earlier period previously referred to.

Before getting through the upper part of the work the dredge became disabled, and as it was on in the autumn, operations were stopped for the time being. We understand, however, that it is the intention of the contractor to complete the work by hand labor and teams.

As there has been no freshet since the carrying out of so much of the work, we cannot say definitely what the effect will be, but there is every reason to believe that it will be as anticipated ; as last spring, when only the cut through the bar was made, the water got away much more quickly than usual, and it is now expected that there will be no danger from flooding and that good drainage will also be afforded these lands, which are of excellent quality and only waiting to get the water off to make the best of farms, and we feel that this will be accomplished when this work is completed.

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LITTLE BEAR CREEK DRAIN.

LETTER FROM W. G. McGEORGE, O.L.S.

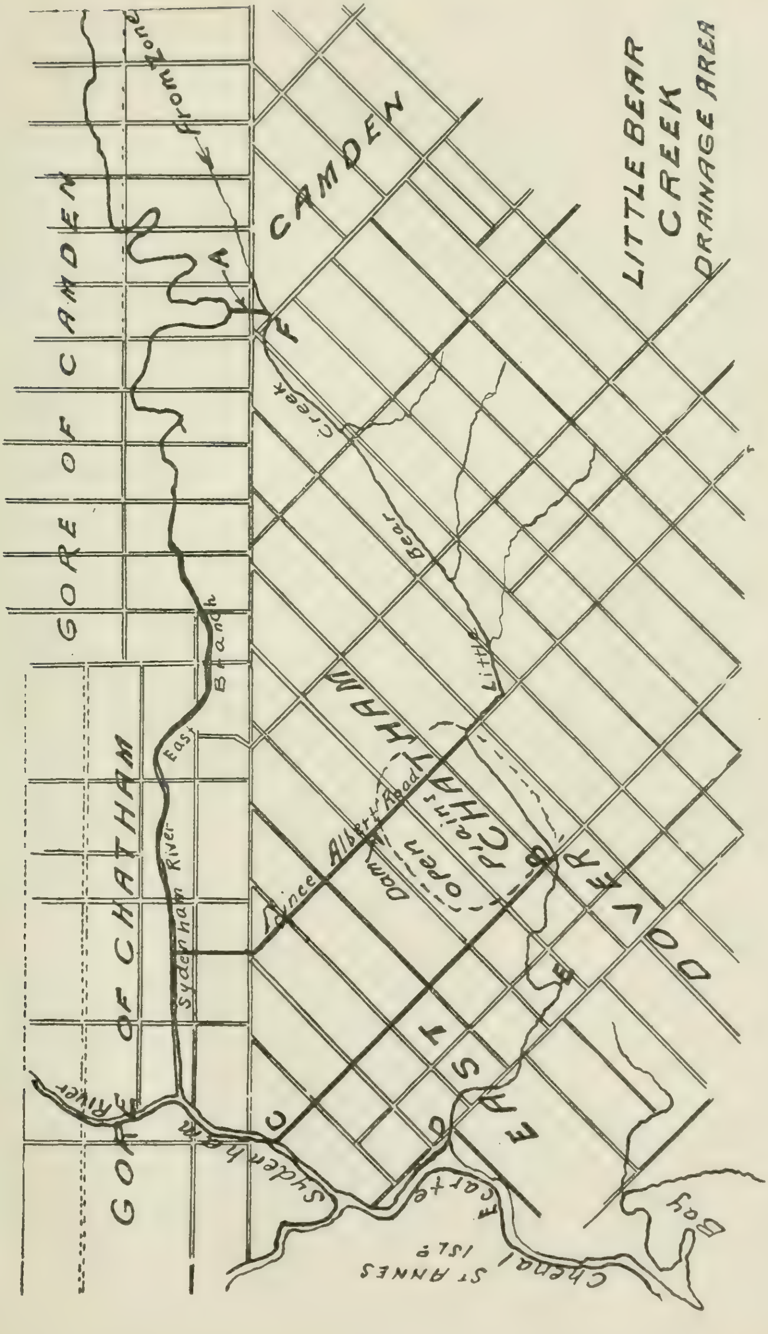
Little Bear Creek takes its rise in the township of Zone, in the county of Kent, and running nearly parallel to the River Thames and River Sydenham, makes its outlet in the Chenal Ecarte, an outlet of the River St. Clair. After leaving Zone it passes through the townships of Camden, Chatham and Dover East. At the westerly side of the Township of Chatham it spreads its waters over a large area of land, some five miles long and four miles wide, and there it has no well defined course. At the Chatham and Dover Townline the channel is resumed and is continued through Dover to the outlet.

A very large area of land in Chatham was formerly flooded nearly the whole summer of each year. This land was partly open marsh and partly timbered. This land, at about nine miles from the mouth of the creek, is only at an elevation of about eight feet above the surface of the water in the Chenal Ecarte, and at about seven miles it is only four feet above the same surface.

The first improvement made was by tapping the Creek at a high elevation at the Townline of Camden and Chatham (at A on plan,) diverting the waters of the upper stretch in Zone and Camden, by a short cut, into the river Sydenham, at a cost of some six thousand or seven thousand dollars. This cut has, through time, become greatly enlarged and has done a great deal of good. The next improvement was in the Creek in the township of Chatham and a short distance in Dover. The expenditure was about $30,000, but this work was quite inadequate. It was done with plough and scraper and was costly for the size of the drain.

About twenty years ago the drain was tapped at the Chatham and Dover Townline by a drain along this Townline to the River Sydenham (from B to C on plan). This tap drain, probably six miles long, and costing about $30,000, passes for half its length through low, marshy lands very little higher than the River, and was chiefly beneficial in making a good road and in cutting off water from passing into Dover between the Creek and River. The County of Kent contributed about $10,000 as an assessment on the Townline.

Another tap drain was made on the Prince Albert Road in the Township of Chatham, the next side east of the Chatham and Dover Townline, and about two miles and a quarter east of the townline. It was made to extend from the Creek to the River Sydenham and is about five miles long. Its cost was about $12,000. This has done good in making the road and relieving the Creek, but complaint is


LITTLE BEAR CREEK
DRAINAGE AREA
GORE OF CAMDEN
CAMDEN
From Zone
A
F
Little Bear Creek
East Branch
Sydenham River
GORE OF CHATHAM
CHATHAM
Prince Albert Road
Dam
Open Plains
B
C
EAST DOVER
Sydenham River
Chenal Ecarte
St ANNES ISLE
Bay

made that lands are flooded that were before its construction beyond the influence of the Creek, and that the water should not have been diverted in this direction. I may say that much of the land along this road is only some seven or eight feet higher than the River, and on occasions the River rises seven or eight feet.

It is not now considered with us advisable to make tap drains in such low land. River floods are becoming higher from year to year in these rivers. The Prince Albert Road Tap was made about ten years ago.

Some eight or nine years back the Dominion Government through the influence of the member for Kent, dredged out Little Bear Creek from its mouth some three or four miles up (from D to E on plan) into Dover, and made it navigable that far for small vessels and useful for rafting logs, etc., and the township of Chatham about the same time on my report improved the Drain and Creek from the Camden and Chatham Townline through Chatham and in Dover to the termination of the Government work (E to F on plan), at the road between Concessions 13th and 14th of Dover East at Lot 20. The work in Dover, and for about seven miles in Chatham was done by a powerful steam dredge, and the drain in Dover was made forty feet wide, and with four feet of back water to the Chatham and Dover Townline, and from this point the dredge was floated by placing dams behind it at intervals, and supplying water by portable engines and chain pumps, until the dredge was carried to an elevation some twelve feet above the water at the entrance to the Creek. In Chatham the cut was about thirty feet wide and six feet deep. This is much the cheapest and most effective way to do such work.

A fair paying estimate for such work in ordinary cases is from ten to twelve cents per cubic yard of excavation. Of course in an inland situation, where a dredge would have to be built on the ground, and where it would have to be broken up upon the completion of the work, an estimate would require to be made to accord. Say dredge first cost $10,000, value of deteriorated machinery at removal, $2,000 to $3000.

Beyond the dredge work the drain was continued to the Camden Townline of smaller dimensions, and work was done with plough and scraper.

After the drain was completed use was made of it in floating logs to its injury, and many new drains were made leading into it and others were enlarged, and now it is found that the Little Bear Creek drain requires to be enlarged and improved over about the lower half of its length, and it is purposed to carry out the improvement in accordance with the report and by-law which I enclose, and which will give you the information you desire. In fact, the work is now under way, two powerful steam dredges being at work, and it is expected that the whole will be completed next summer. This work deals only with the western part of Little Bear Creek Drain. The rest of Little Bear Creek in Chatham is in a fine state of repair, and as you will see, part of the Prince Albert Road Tap is changed into a branch of the Drain.

Dover and Camden acquiesced in the assessment to pay for the work, and there has been very little change made at the Court of Revision The assessment was chiefly for outlet, under Section 590 of the Act, and each parcel of land in the drainage area pays in proportion to the cost of the part of the drain used for its waters, no lands paying any of the cost of the work above where the waters of these lands enter the drain, and all lands using the drain pay alike for their portion, whether they are near the Creek or remote from it.

Where lands pay for a benefit, it is where water is cut off by the embankment of the Prince Albert Road, and by the proposed dam in the Prince Albert Road Drain, where the dredge stops.

The work, owing to keen competition, was let at about two-thirds of my estimate.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members*]

NIPISSING & JAMES' BAY RAILWAY SURVEY.

By J. A. PATERSON,

O.L.S., C.E., Toronto.

On the evening of the 4th July last summer (1893) a party of travellers at the Union Station, Toronto, might have been seen boarding the G. T. R. train for North Bay. By the appearance of their outfit, consisting of transits, levels, rods, etc., it would be surmised that they were on a surveying expedition, and when it was said that they had a box car loaded with provisions, canoes, tents, blankets, etc., it was evident that the expedition was of no small importance. This was the survey and location of what might be called the first division of the Nipissing & James' Bay Railway. An enterprise that might well interest every citizen of this Province, as it concerns the development of the northern part of Ontario, an immense region hitherto comparatively unknown.

It was in April, 1884, that the charter was granted by the Dominion Government, since which time the enterprise has languished from want of encouragement from capital. But at last to set the enterprise on its feet, by a proper survey and estimate of the cost, a couple of public-spirited, enterprising gentlemen put their hands in their pockets and raised the necessary funds.

At the time when the charter was granted the attention of most enterprising men was directed to the possibilities of the North-West, and this Province was drained of men and money. Latterly the rest of the Province has occupied public attention, railways and other public works being built, public money being thus far well utilized. But now the time has come for the development of this northern district, and to do this the railway is the great agent and pioneer, opening up a highway for traffic through the heart of the country and connecting the existing lines of railway, that permeate the rest of the Province on the south, with James' Bay, the southern prolongation of Hudson Bay, on the north.

The total length of the line will be about 360 miles. Commencing at the Town of North Bay, a thriving municipality on the north bay of Lake Nipissing, distant from Toronto 225 miles, connecting therewith the Grand Trunk Railway—connection may also be there had with the Canadian Pacific Railway—the line takes a north-westerly direction, rising gradually with some interruptions till at 21 miles distance the elevation is 577 feet above Lake Nipissing, which is 642 feet above the sea, so that the total elevation at this point is 1,219 feet above the sea, this will be the highest point on the line. From there the line descends 270 feet gradually to the level of what might be called the Lake country at about the 30th mile, a country dotted with innumerable lakes and lakelets, with short connecting rivers. The method of travelling in this northern district is by water, which consists of stretches of deep, still lakes or ponds, connected by streams interrupted by rapids and falls, around which the light canoes are portaged by hand. Traversing this country for forty miles, the line touches the north-east arm of Lake Tamagaming—the Indian word Tamagaming is of the Cree language, meaning "deep water"—the water being in some places 300 feet deep and same color as that of Lake Superior, is full of trout and white fish and has been one of the chief fishing grounds of the Hudson Bay Company for over one hundred years, supplying many of their posts with fish. This is a very extensive lake, having many extensive deep bays with many islands, and looks as if nature not having room to scatter all her lakes, threw the balance in a heap at this place. The Hudson Bay Company have a trading post on Bear Island, in the middle of the lake. It has two outlets—one flowing southerly into the Sturgeon River, thence to Lake Nipissing; the other northerly into the Montreal River, thence into Lake Temiscaming. The line continues from Lake Tamagaming 22 miles further to reach Lake Temiscaming, a total of 90 miles from North Bay, descending over 300 feet from the general level of the lake country to this lake, which is about thirty feet lower than Lake Nipissing, its elevation being 612 feet above the level of the sea. In approaching Lake Temiscaming the line passes through a large district of fine agricultural lands, reported by actual surveys to contain about 95 per cent. arable land. Lake Temiscaming is a magnificent stretch of navigable water, the largest and deepest of the whole course of the Ottawa, extending 75 miles without any obstruction to vessels of the largest tonnage. The name Temiscaming is from the Ojibway language and means "deep water" also, it consists of three lakes—the lower, middle and upper—connected by narrow straits, with its tributary the River Blanche, which enters at its northern end, navigation is continued many miles further into the interior. It is the great basin of the Ottawa and drains 19,000,000 acres. The land in this district is good, similar to the best in Canada, with a climate equal to any on the north shore of the St. Lawrence. To this lake would be the first division of the railway.

Leaving this lake, the line again rises to the upper level of what might be called the table land, which may be described as a level clay plain, with a number of rocky hills and ridges protruding. At about ninety miles distance Lake Abittibi is reached, which is about thirty feet below the ordinary level of the plain described. This is also a very extensive lake. The outlet is by the Abittibi River, which flows northerly to the Moose River and thence to James' Bay. This would form what might be called the second division of the railway. From Lake Abittibi to Moose Factory, situated on an island in the mouth of Moose River—where it enters James' Bay—the distance is about 180 miles. After leaving the locality of Lake Abittibi the line begins to descend rapidly till it comes to the level of an immense plain, covered with belts of timber, intersected with stretches of peat beds ; the soil is clay, so that there are large stretches of good strong alluvial soil.

James' Bay, named after Capt. James, who wintered there in 1632, begins at Cape Jones on the east side of Cape Henrietta Maria on the west, and runs south about 360 miles, with an average breadth of 150 miles. It is merely a prolongation of Hudson Bay. With many people Hudson Bay is apt to be associated with the Polar regions, yet no part of it comes within the Arctic circle. The latitude of its southern extremity James' Bay begins about 51 degs. north, is south of London, England. It never freezes over, and is connected with the Atlantic by a wide passage. This great Canadian sea, including James' Bay, abounding with whale, porpoise, salmon and white fish, and to the further north with seal is about 1,000 miles long north and south, and more than 600 miles wide at its north part ; total area about 500,000 square miles. At Moose Factory, farming and gardening are carried on by the officers of the Hudson Bay Company. Oats, barley, beans, peas, potatoes, turnips, beets, carrots, cabbage, onions, tomatoes, etc., are grown without any more care than is required in other parts of Canada. Horses and cattle are kept and plenty of fodder is found for them.

Professor Bell says :—" Around James' Bay and up the eastern " sides of Hudson Bay lie great deposits of iron and coal so close " together that this district about James' Bay may yet become another " Pennsylvania."

Another explorer says of the district about James' Bay :—" This " district is the richest mineral region in the Dominion, perhaps on " the continent. Coal and iron are also to be found in abundance " along the rivers south of James' Bay."

Another explorer in his report to the Ontario Government says :— " There are also in the neighborhood of James' Bay, north of the " height of land, enormous peat beds, perhaps the largest in the " world, from eight to twenty feet thick, besides lignite or Brown coal, " Kaolin and Iron."

Other resources of James' Bay are : Furs, oils, whalebone, feathers, quills, fish, castoreum, lead ore, lumber, ivory, tallow, gypsum. The iron ore is particularly valuable, as it contains a great amount of carbonate of magnesia, making it available for the manufacture of Bessemer steel.

The district from around Lake Abittibi to James' Bay, with its clay formation, has endless resources for the production of aluminium, which by newly discovered processes, can now be produced at less than 25 cents per pound, and when produced in the quantities that this district warrants the supply of, it will take the place largely of silver, copper and tin. The Kaolin deposits are extensive, and the very best qualities of china and porcelain may be also manufactured ; there are also beds of the finest sand for the manufacture of glass. Large quantities of gypsum, fire-clay, brown and yellow ochre are to be found ; there are also many signs of petroleum and natural gas.

All these valuable resources lie waiting development. Now is the time to revive and stimulate the business of the country by the building of this railway; but such an undertaking needs the backing and co-operation of both the Provincial and Dominion Governments to a much greater extent than at present proposed.

The location of a good railway line through this country is no small undertaking. After leaving the settlement in the vicinity of North Bay there are no roads of any kind, and the dense, pathless forest, with its heavy undergrowth, is entered. The instructions given were to secure the most direct possible line, the maximum grade to be 1.33 feet per 100 feet going northerly, and 1 foot per 100 feet going southerly; the sharpest curve to be not less than that of 1,146 feet radius. As an early report and estimate were desired two parties were sent out. The number in each party varied from ten to eighteen men, as circumstances required. On the first thirty miles, there being no lake or river convenient, the provisions and camp outfit had to be carried on men's shoulders, and the days that camp was moved were the great and eventful days of the survey. A trail or path through the bush having been opened out, three or four miles ahead in the direction the line was likely to go, all the surplus provisions, etc., having been carried forward by the packmen, and the survey and location having been completed in the district of the existing camp an earlier start than usual was made, and at daybreak blankets, tents, etc., were rolled up, each man making up his pack into as convenient a shape as possible for the mounting on his shoulders. Each pack being made up to include as much as each man could struggle with through the woods and was often a curious conglomeration of camp outfit. Blankets, pots and pans, pork and stationery, flour and grindstone, canned goods and personal clothing. The pack mounted on the shoulders at the back of the neck, the tump line or strap passing round the forehead by a loop, made the portager or packer sometimes top heavy, when he began to get weary, and if he passed too close to one tree, trying to dodge another, the recoil might send him stumbling headlong over the lying timber on the trail. One incident that might have been serious happened simply; the pack of one of the party was surmounted with the large tin bake pan, to rest and adjust his pack he backed up to a large lying pine, intending to deposit his pack on tree; he laid it down and just as he was about to take his head from the loop, the tin pan being bright and smooth, slid on the round tree and the whole pack of about one hundred pounds shot off over the tree like a catapult, took the stalwart portager at a disadvantage, carrying him with it head over heels.

A trial or preliminary line was always ran ahead first, and if not satisfactory, another and another, till the best line possible in that locality was got. Going to the camp or to the end of the survey line by short cuts through the bush was also an interesting part of the service; every moment of time possible was utilized in running in the line, and then in getting to camp across country as one best could, it sometimes happened that some adventurous spirit would overshoot the mark, pass beyond and thus be late in getting there, and, of course, would then be the recipient of much chaffing, as well as chaffing enquiries as to the country he had seen ; had he explored a a new route ? It would, of course, be decidedly awkward to be benighted in the woods, as it darkens quickly and it is useless then attempting to travel, so one had better hang himself up on a limb till morning.

A number of fine pine trees had to be felled on the line, some over three feet through, regular monarchs of the forest. It was always a source of regret to the engineers to cut down such magnificent timber, also to the axemen on a hot day with the cry " Hurry up now, boys ! Push her down !" ringing in their ears, as it is no easy job to throw down such giants hurriedly, but four good men would gather around and a merry chime would be rung, as the four axes swung, with clip ! ! clip !—clip ! ! clip ! and then hurrah ! cries of look out ! and

" Beware the pine tree's withered branch,"

or dead limbs sometimes fly where least expected, and fall so close with sickening thud as to make one shiver.

This country is the home of the moose, of which there are a great many. Their paths were plentiful and sometimes well worn with great foot prints. One of the axemen said that " The woods were crawling with them !" It is difficult to understand how these immense beasts, with immense branching horns, get so fast through the dense bush ; of course they have their runways, but when taken unawares they break off anywhere. They are protected by a prohibitary law till October, 1895. But of course a person may kill one in self-defense ; it is said that the meat is very fine, particularly as a change from salt pork. As the party had started out with a certain quantity of provisions, calculated to last a certain time, and it was necessary to connect the two surveys at all hazards, as the provisions got lower, the axes seemed to ring quicker, till all the party got worked up to a state of enthusiasm to push ahead, and latterly the cry of " Line ahead." by the axemen to the transitman were frequent, and occasionally if there was any delay in the transit, the cry was heard ringing down the line, " Come ahead with your lorry " till finally the wonder ceased at the moose running in the woods so. The party all seemed as active as moose. Some one was heard to say that the spirits of murdered moose had entered into the party. Anyway the surveys were connected and a good line located. The first thirty and odd miles ready for construction, the rest of the distance has yet to be run over again. As soon as the line reached the Lake country, birch bark canoes were used to travel in and move camp with. They were light and portable, as it was necessary to carry them across from one lake to another when the rivers did not connect. It might be noted here that similarly as the axemen said of the woods with moose, he also said of the lakes with fish, " They were fairly crawling wid them "—black bass, pike, trout and white fish.

Regarding the timber, which is so plentiful through this country, it has been estimated that there is enough pine alone to supply traffic for the railway when built for seventy years. Experts were sent out specially who after careful and exhaustive explorations made their reports and estimates. Then there are lots of fine cedar, black spruce, black birch, tamarac, etc., the whole country is densely covered with all sorts of timber, and what is not required for lumber is suitable for making pulp. The quantity of pulp wood is illimitable and there are so many convenient water falls that mills for the manufacture of pulp can be put up as required. And when it is noted that the new processes for manufacturing the pulp when produced are so much improved now, that a texture equal to the finest silk can be produced, it is evident that this district may yet become a richer producing country than the cotton fields of the South. For it is certain that many kinds of cloth and paper will be superceded by this material, and when clothing can be manufactured better and cheaper of pulp, why should not Ontario yet become the great *Manchester* of the world?

Again the question might well be asked: Why do the enterprising Americans value so highly their bit of northern country called Alaska, while Canadians are apparently satisfied to sleep peacefully with a larger, more valuable expanse of territory, lying north of James' Bay, through Hudson Bay to Baffin Bay, with its whale, porpoise, seal, feathered game and minerals, and all that fur-producing country that has made the English shareholders of the Hudson Bay Company so wealthy? Why is this? Echo answers why?

It surely must be because they are asleep, and yet people prate about hard times, the dulness of trade, with all these avenues of trade lying dormant at their back door, and no other country to interfere with it.

Many rich Toronto men, lacking enterprise, would rather sit down on a few corner lots in the city and wait till they rise in value. Aldermen would rather squabble over putting on or taking off half a mill taxation, than stir outside and bring in trade.

If the construction of this railway could be commenced at once, immediate employment would be given to thousands of men. While the development of the various avenues of trade that would result therefrom would give continued employment to all classes of skilled and unskilled labor for generations. This is the only practical solution of the difficulties of the labor question that present themselves to us now in all our cities.

The Ottawa and Ontario Governments might well turn themselves loose on these matters, and metaphorically kill the "*Giant Hard Times*" in Canada.

DISCUSSION.

Mr. Tyrrell—I am extremely pleased to hear this paper. Perhaps I take more interest than some others in that part of the country, having been up there several times, and I often wondered what was the principal object in building this railway to James' Bay, but I have been enlightened by this paper. It appears it is not so much to reach a seaport at Moose Factory as to develop the resources themselves. From what I know of the shores of the bay they are not suitable, in that part at least, for seaports, vessels not being able to get within ten miles of the shore. It is very unfortunate, but it is a fact nevertheless. But, as the paper states, the resources of the bay are large, and I have no doubt the wealth of the country would be very great if developed. As I have said in some papers and letters published in newspapers and other places, we have been allowing the Americans to scoop out for years the wealth of Hudson's Bay in the form of whales. They have been, and are still, catching whales in the northern portion of the bay every year, and we do not seem to be making any effort at all in that direction. As far as I know, no Canadian vessel has ever thought it worth while going into the bay.

Mr. Niven—I may say that I know something of that country. In 1885 I connected the southern portion of the system of survey there with the Temiscamingue country by running a meridian line 30 miles north to the township of Lorrain which was surveyed. We always heard that there was a fine tract of land at Temiscamingue, and I expected to have reached it when we got to this township, but we surveyed a township there that was simply in the rocky tract like a great many others. However, in the following year the system of survey was produced farther north, and we certainly struck the promised land then. As far as the eye could reach, from a hill a a short distance north of Temiscamingue, the country was just spread out before you, and it certainly was one of the finest sights I ever saw. I was describing this hill and the locality to a gentleman in Toronto after I came back and he at once thought it would be a capital place to erect a summer resort, but I hardly thought that it would do for that. Twenty-six townships have been outlined there and twenty of them, I think, have been subdivided There are townships there that you can scarcely find a stone in, and perfectly level. I have surveyed a township there and the only hill on it was at the extreme north-east corner, a little elevation of about 40 feet. So far as the James' Bay Railway is concerned, I think it is very much in the interest of Toronto that it should be built. The Ottawa lumbermen at that time were very anxious to have it there, and Mr. Gillis, whom I met there, told me that he would put his mills on the Canadian side and cut his lumber there, and he expected to cut, I think, twenty million feet for a great many years. However, the C. P. R., I think, has some designs on that country on the east side of the river, and it may be that Toronto will be too late if they do not act quickly. So far as the road is concerned, I have no doubt that a practicable route can be found, and by adopting the chain of waters that goes from the Tamagaming, (I don't know whether the line has been located there, but I have always thought that they would adopt that), navigation from the Tamagaming Lake would bring all sorts of products down. I do not speak of the farther end of the railway ; I never was beyond the Temiscamingue country, but I know whereof I speak regarding that when I say that there is not a tract of land in Ontario to-day open for settlement that is the equal of the Temiscamingue country.

Mr. Butler—I was up there on the first exploration for this line towards Hudson's Bay. We stopped at Tamagaming and I can re-echo what Mr. Paterson has so well said as to the resources of timber and minerals between the Montreal River and North Bay.

The President—I certainly think with Mr. Niven that if the City of Toronto expects to keep ahead in a commercial way, she can only do so by continuing in the line that has brought her prosperity in the past. There is no question about it that the City of Toronto owes her present commercial prominence in this province to the fact of her pushing out railways years ago, the Nipissing and others, and I think if she wishes to retain that position she will have to do it in some such line as we have been speaking of.

Mr. Paterson—In writing the paper I had some little hesitation, because I felt that possibly the subject was not technical enough for the society, and in beginning to write with the intention of only writing a short paper I hardly knew where to stop, the subject was so extensive ; and my mind was so full of what I had seen there in the way of scenery and other things, that I felt possibly it would be difficult for you to entertain some of the ideas regarding the subject that I do myself. Regarding the possibility of having an outlet from Moose Factory to England, I think that idea is more connected with the scheme which the Winnipeg people had, their idea was to have an opening from Winnipeg through to England. This scheme would not entertain that idea just now. We want to build up Toronto and Ontario, and we have already an outlet to England. As to the shallows of the James' Bay, of course the bay is shallow and very large vessels taking deep water may not be able to get there, but we have ships that go from there to England belonging to the Hudson's Bay Company, and the idea is that larger seaports for larger vessels could be established from some other points and lighters used to go down to the terminus of the railway. These are matters of detail, but I should be very much pleased if at another meeting I could give an extension of this subject with perhaps a few more practical results.

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DESCRIPTIONS OF CITY PROPERTIES.

BY T. B. SPEIGHT,
O.L.S., Toronto.

Two papers on Descriptions have already been read before this Association since its formation, and the subject has been so ably presented to you by the authors, Messrs. Klotz and Gaviller, that it may seem to some of our members an unnecessary task to re-open the topic.

It is, nevertheless, a fact that defective descriptions of recent dates are frequently to be met with, and the writer is of opinion that an interchange of ideas during discussion may be of benefit to all; and the purpose of this paper is to promote such discussion.

The object of a description would seem to be twofold, firstly: that the parcel in question may be located and its position defined on the ground by a surveyor, for the benefit of the owner in the enjoyment of his property; and secondly: that the position of the property so described and located may be easily determined with relation to surrounding properties by the person who is searching the title.

Surveyors in and about Toronto who have been called upon to describe properties held, or to be placed under the "Land Titles," have had a special incentive given them to devote more time and thought to what is necessary in a description to fulfil the above conditions from the fact that the Master of Titles insists upon these conditions being fulfilled. Having from the responsible nature of his position, made a special study of this subject, the Master of Titles has long been recognized as a high authority, and his necessary criticism of descriptions which have come before him has resulted in much improvement in this important branch of a surveyor's practice.

The subject of bearings deserves more attention than it has hitherto received. The use of bearings without any statement of the line with regard to which the courses are run is a great source of trouble. As a *matter of law* every bearing is astronomic unless it can be gathered from the description, or possibly from all the surrounding facts, that something else is intended. See Thibaudeau *vs.* Skead, 39 Upper Canada Reports, page 387. This being the case, it is obviously the duty of every surveyor drawing out a description with bearings to state whether astronomical courses are intended, or whether, as is usually the case, the bearings are calculated from some line or street which is taken at a generally recognized course. Every description which contains a bearing should therefore include a statement that such a line is taken as the governing line, on such and such a course, or that the bearings are astronomical.

The same description applies to plans. It is obviously convenient in practice, and is a great saving of expense, that in most cases an astronomical bearing should not be taken, but that a street or some other known line should be accepted as the governing line on its recognized course, and the various bearings marked on the plan calculated from this street or line, but it certainly should not be left to be surmised from what the bearings are computed. The fact should be distinctly stated on the face of the plan.

The placing of courses in inverted commas, to show that they are taken from some former plan, survey or deed, is entirely illusive. It is not likely that once in twenty times are inverted commas in a description carried into the deed for which the description is prepared, and even in the exceptional cases these quotation marks are valueless, as they do not indicate the source from which the quoted bearings are taken. Indeed, all that they in fact indicate is that the person who drew the description does not pretend to say whether the course is correctly or incorrectly given, but that it is taken from some unstated source, that he does not guarantee. It is only necessary to put this in words to see how absurd such marks really are when inserted in a surveyor's description.

Where descriptions are prepared for the office of Land Titles for subdivisions, it is obviously necessary that the surveyor should be furnished with a copy of the description of the whole parcel as registered in that office, as the description of the subdivision must be drawn with reference to that in the register which governs the title.

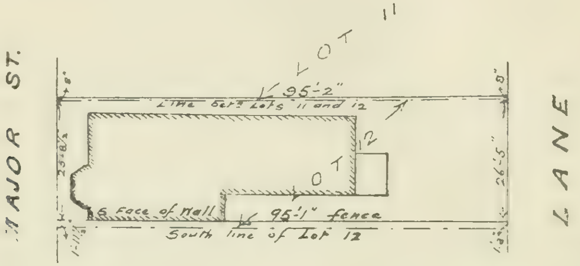
It is of course granted that astronomical bearings are much to be preferred to any other, but, unfortunately, this fact is not recognized by the public, and therefore a surveyor who may be so desirous of obtaining perfection in his plan and descriptions as to take an astronomical observation may with certainty calculate on that observation being taken at his own expense. The only hope we have of astronomical bearings being introduced into practice for this kind of work is in the possible event of an *Act* to make astronomical bearings on registered plans compulsory; then the public would not question the expense, and the sooner that the public know that surveying is something more than merely measuring a block of land with a chain or steel tape the better both for the public and the profession.

As the methods employed in making surveys in cities and towns differ materially from those required in running lines in rural districts, so also the description of a parcel of land occupied by a building and surrounded by other buildings has features unlike those contained in a description of vacant or farm land.

A surveyor in the constant practice of his profession is liable to fall into a fixed groove, and errors of phraseology in his descriptions may pass unnoticed by himself while patent to others. With the request that you will bear this fact in mind, I beg leave to submit the following examples of descriptions taken from our description books as exemplifying three cases frequently met with in a city practice:

EXAMPLE I.

"All and singular that certain parcel or tract of land and premises situate, lying and being in the City of Toronto, in the County of York and Province of Ontario, being composed of the southerly 8 inches of lot number 11 and of part of lot number 12, as shown on a plan filed in the western division of the Registry Office for the said City of Toronto as number "D 195"; and which said parcel is more particularly described as follows:



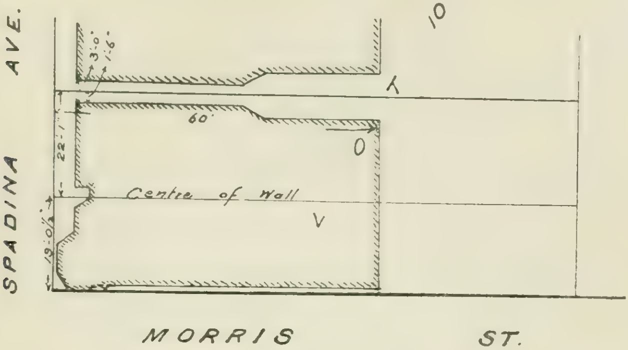
Commencing at a point in the easterly limit of Major street, distant 1 foot 11½ inches, measured northerly along the same from the southerly limit of the said lot 12, said point being in the westerly production of the southerly face of the southerly wall of the dwelling now known as No. 3 Major street; thence, easterly, in a straight line to and along the said face of wall and along the existing fence forming the southerly boundary of the rear premises of the said dwelling, No. 3 Major street, in all a distance of 95 feet 1 inch, to a point in the westerly limit of a lane shewn on said plan, and which point is distant 1 foot 3 inches northerly from the south easterly angle of said lot 12; thence, northerly, along said limit of lane 26 feet 5 inches, more or less, to a point 8 inches northerly of the north easterly angle of said lot 12; thence, westerly, parallel to the line between said lots 11 and 12 and distant 8 inches northerly therefrom, 95 feet 2 inches to the easterly limit of Major street aforesaid; thence, southerly, along the last mentioned limit, 25 feet 8½ inches, more or less, to the place of beginning."

It will be observed that no bearings are given. The reason for their omission is that they are not necessary to the proper identification of the parcel, and if calculated bearings had been given they would probably have differed from the patent bearing, N. 16° W. or N. 74° E., as shewn on the original plan, and thus have confused the future searcher.

EXAMPLE II.

"All and singular that certain parcel or tract of land and premises situate, lying and being in the City of Toronto, in the County of York, and Province of Ontario, being composed of parts of lots numbers 10 and 11, as shewn on a plan filed in the western division of the

Registry Office for the said City of Toronto, as number "D 254," and which said parcel is more particularly described as follows:



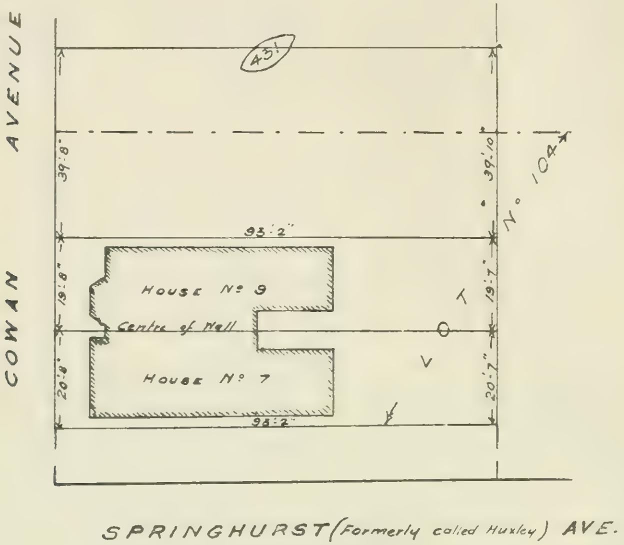
Commencing at a point in the easterly limit of Spadina avenue (formerly called Brock street), distant 19 feet and one-half inch, measured northerly along said limit from the southwesterly angle of said lot 10, the said point being opposite the centre line of partition wall between the two brick dwellings now standing on said lot 10 and the southerly portion of said lot 11; thence, north 73° 56′ east, to and along the said centre line of wall and along the easterly production thereof, in all a distance of 110 feet; thence northerly, parallel to the said limit of Spadina avenue 21 feet 7½ inches, to intersect the easterly production of a line drawn through the centre of the passage between the most northerly one of the hereinbefore mentioned dwellings and the next dwelling to the north thereof; thence, south 74° 10′ west, to and along the said centre line of passage and along the westerly production thereof, in all a distance of 110 feet, to the said easterly limit of Spadina avenue; thence, southerly, along the last mentioned limit, 22 feet 1 inch, more or less, to the place of beginning.

Together with a right of way at all times, in common with others entitled thereto, over a strip of land 1 foot 6 inches in width, immediately adjoining the northerly limit of the hereinbefore described parcel and extending easterly from Spadina avenue to a depth of 60 feet, and *reserving* a right of way at all times over and along the northerly 1 foot 6 inches of the westerly 60 feet of the said hereinbefore described parcel.

Note.—The bearings herein are calculated with reference to the line between lots 10 and 11, it being assumed N. 74° E."

Example III.

"All and singular that certain parcel or tract of land and premises situate, lying and being in the City of Toronto, in the County of York and Province of Ontario, being composed of part of the westerly portion of lot number 104, as shewn on a plan filed in the Registry Office for the said county as number 431, but now in the western division of the Registry Office for the said City of Toronto, and which said parcel is more particularly described as follows :



Commencing at a point in the easterly limit of Cowan avenue, as widened by By-law, distant 20 feet 8 inches, measured northerly along the same from the southerly limit of said lot 104, said point being in the westerly production of the centre line of partition wall between the two semi-detached brick dwellings now standing on the southerly portion of the westerly part of said lot 104 ; thence, north 74° 3′ east, to and along said centre line and the easterly production of the same, in all a distance of 93 feet 2 inches ; thence northerly parallel to said limit of Cowan avenue, 19 feet 7 inches, more or less, to a point in the easterly production of a line drawn parallel to the northerly face of the most northerly wall of said dwellings and distant 1 foot and 6 inches northerly therefrom ; thence, south 74° 6′ west, along the line drawn as aforesaid, 93 feet 2 inches, to the easterly limit of Cowan avenue aforesaid ; thence southerly along the last mentioned limit 19 feet 7 inches, more or less, to the place of beginning.

Note.—The bearings herein are calculated with reference to the north limit of said lot 104, it being assumed N. 74° E."

The party wall is an important feature in each of Examples II. and III. and is probably one of the most delicate boundaries met with in a city practice. It may, therefore, not be out of place to devote some space to this subject, giving some Court decisions in regard to it, although not coming entirely within the title of this paper.

Watson vs. Gray, 14 Ch. D. 192 (1880).

The following clause appeared in the conveyance :—

" It is hereby agreed and declared by and between the said parties hereto that the north and south gables and walls of the said messuage or dwelling house and hereditaments hereby conveyed shall be and remain party walls, and that the eastern and western walls and the pallisades in front of the said messuage or dwelling house shall belong exclusively to the said Jane Lyons, her heirs and assigns."

Mr. Justice Fry, after stating this proviso, said : " What is the meaning of the term ' party wall ' as there used ? The words appear to me to express a meaning rather popular than legal, and they may I think be used in four different senses.

" I. They may mean, first, a wall of which the two adjoining owners are tenants in common, as in Wiltshire *vs.* Sidford and Cubitt *vs.* Porter. I think that the judgments in those cases shew that that is the most common and primary meaning of the term.

" II. In the next place the term may be used to signify a wall divided longitudinally into two strips, one belonging to each of the neighboring owners, as in Matts *vs.* Hawkins.

" III. Then thirdly the term may mean a wall which belongs entirely to one of the adjoining owners, but is subject to an easement or right in the other to have it maintained as a dividing wall between the two tenements.

" IV. Lastly the term may designate a wall divided longitudinally into two moieties, each moiety being subject to a cross easement in favor of the owner of the other moiety."

As it is not the business of a surveyor to say what constitutes a party wall, or what sort of a party wall it is, he may write after the words " party wall " in his sketch or plan, a reference to the instrument creating it. A surveyor should be careful before he writes the words " party wall " on a line in his sketch or plan to ascertain whether it is a party wall all the way up from the ground or only for a portion of the distance ; and if it is only a party wall for a certain distance, write " party wall for thirty feet from ground " (or as the case may be). This is suggested from the following passage : Lloyd's Law of Building and Buildings, at page 342—" Buildings upon a party wall : Either of the owners of a party wall has the right to increase its height, provided such increase can be made without detriment to the strength of the said wall, or to the property of the adjoining owner, but he makes such addition at his peril. The exercise of the privilege brings about the peculiar circumstance that a wall may be a party wall to a certain height and subject to the sole ownership of one of the adjacent proprietors above said height. In such a case the court will hold that so far as the wall between the buildings is concerned it is a party wall, while it may grant an injunction prohibiting the removal of the other portion." " We have known in this court," says James L. J. in Weston *vs.* Arnold, " cases in which property in London is intermixed in such a way that one man's basement and cellar extend under another man's shop ; and again the first floor of one house is over the shop of the next house. In such a case there would be a party wall between the two buildings below, while above would be only a private partition between two rooms in the same house There is nothing in fact or in law to make it impossible or improbable that a wall should be a party wall up to a certain height, and above that height be separate property of one of the owners. But the owner of one half of a party wall has no right to extend it to the line of the street, thereby occupying a portion of his neighbor's land not built upon."

Must be no window in party wall.

Sproule *vs.* Stratford, 1 O. R. 325 (1882).

The defendant raised the party wall beyond the building of the plaintiff (the adjoining owners). This he did with the plaintiff's consent. But when he opened a window through the raised part of the wall, the plaintiff applied for an injunction. Chancellor Boyd decided : "My conclusion is, that the making of the window in the wall was an unauthorized user of it by the defendant, and that the plaintiff has the right to enjoin him against its further continuance, and to a declaration that the extension in height of the wall in question, is a continuation of the party wall between the adjoining properties of the plaintiff and defendant."

Brooke *vs.* McLean, 5 O. R. 209 (1884).

Case of one owner building a high building and using a wall (on adjoining property) as a party wall, thereby weakening same. Damages given.

The suggestions thrown out here are by way of warning surveyors against making plans and sketches that might mislead. While surveyors are not responsible for their advice in the same way as solicitors, yet they have a certain status as advisers. Thus in Haberdashers Co. *vs.* Isaac, 3 Jur. N. S., 611 (1857), Wood V. C. said : "The Defendant says that Mr. C., the agent whom he employed in 1853-4, was not a sufficient protection to him. It is true he was not a solicitor, but he was a surveyor, and surveyors and builders have generally very good notions of the legal effect and consequences of the stipulations in leases, and are perfectly competent advisers."

DISCUSSION.

The President—There is one suggestion Mr. Speight has made which would be a capital thing if it be carried out—that is, that a Registrar should not be allowed to receive any deeds in which the descriptions are not by astronomical bearings ; but it would be pretty hard to get such an Act passed through the Legislature.

Mr. Sankey—I am personally very much interested in descriptions of city property, as my principal practice has been in city work. Papers of this kind I think are papers we all ought to read and study. I know there is a good deal in it that is well worthy of our consideration.

Mr. Wilkie—Although I have not had any practice in descriptions of city property, I have had a little in small towns, and I might just mention one case that was brought to my notice a short time ago by the Registrar of the town in which we are practising. It was a mill property that changed hands quite recently, and the Registrar pointed it out to me as a curiosity. One bearing ran to a cedar stump blazed on two sides—remember this description was re-written within the last six months—and this cedar stump has been gone probably thirty years. Another description referred to a barn which has also been gone, I think, about twenty years, and it was written by a lawyer. But I think that description came from the Courts and was of course just copied as being from that source.

Mr. Gibson—Taking everything into consideration, if you want a really good description of city property where there is a party wall, it requires a good deal of skill.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

THE REGULATION MILE TRACK OF THE WINDSOR DRIVING PARK ASSOCIATION.

BY OWEN McKAY,

O.L.S., C.E., Windsor.

THE ground enclosed by the Windsor Driving Park Association, covering an area of $57\frac{1}{2}$ acres, which contains the new race course, the necessary buildings, exercise grounds, etc., is situated just south of the Windsor city limits, and is bounded on the south side by the Canadian Pacific Railway lands, and on the remaining three sides by streets leading to the city, as shown in the annexed plan.

Towards the close of the year 1891, Mr. Joseph De Gurse, O.L. Surveyor and Civil Engineer, Windsor, was requested by the Windsor Driving Park Association to prepare plans, profiles, etc., for a new race track, which they had decided on building. Before proceeding to comply with their request, Mr. De Gurse visited several of the racecourses throughout the country, and also corresponded with many of the leading trackmen with the view of obtaining the fullest information on the subject.

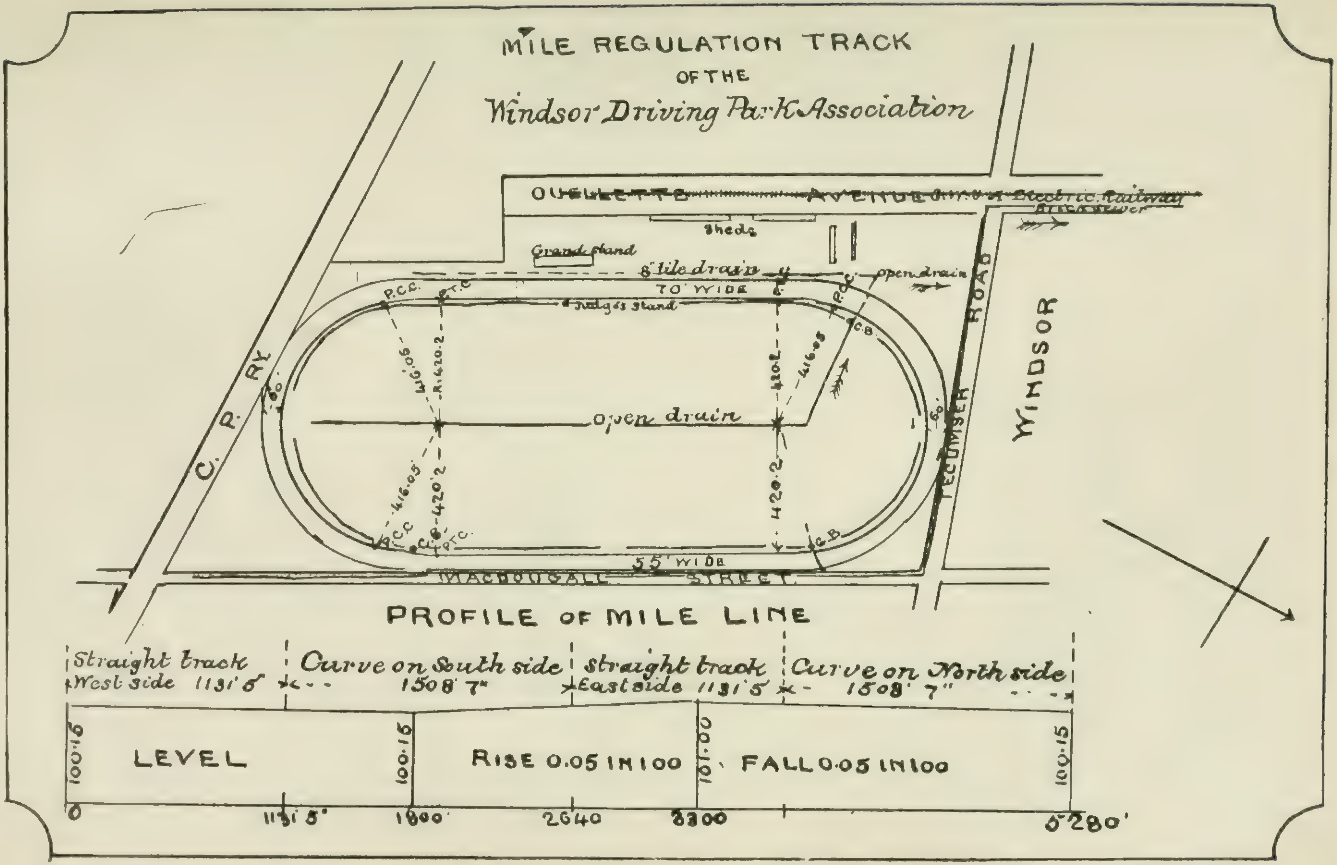
The result of his investigations and enquiries led him to recommend a regulation mile track, with easement or transition curves at the beginning and end of each of the turns, and with grades, widths of track, etc., as set forth in this paper, as the best form of track to build, which recommendations were adopted by the Association.

A regulation mile track when measured on a line three feet from the inside of the track, called the mile line, consists of two parallel tangents, each 1320 feet or $\frac{1}{4}$ of a mile in length, and two semicircular arcs, each of which is also 1320 feet in length, or in other words, one half-mile in length is on tangents and one half-mile on curves.

The radius of a semicircular arc of 1320 feet is $\frac{1320}{3.1416} = 420'.17$ nearly, and the width of track between the two parallel tangents on the mile line is equal to the diameter of the semicircle $= 420.17 \times 2 = 834.34$.

The rule that a race track shall be measured for its true length on a line three feet from the inside fence of the course has been adopted by both the National and American Trotting Associations.

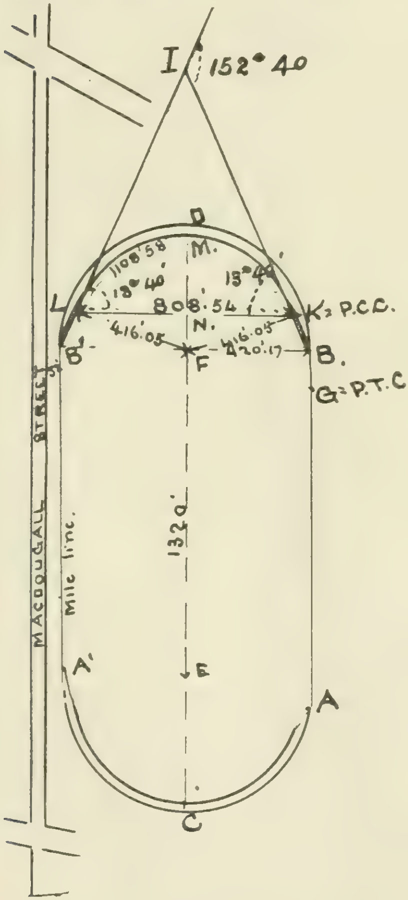
In staking out the track on the ground the mile line was first located, stakes being planted 100 feet apart on the tangents and 25 feet apart on curves, and the inside and outside lines of the course


MILE REGULATION TRACK
OF THE
Windsor Driving Park Association
OUELLETTE AVENUE
Electric Railway
Brick sewer
Sheds
Grand stand
8" tile drain
open drain
70' WIDE
Judges stand
P.C.C.
P.T.C.
P.C.
C.B.
416.05
R.420.2
420.2
open drain
C. P. RY
55' WIDE
MACDOUGALL STREET
TECUMSEH ROAD
WINDSOR
PROFILE OF MILE LINE
Straight track West side 1131' 5"
Curve on South side 1508' 7"
Straight track East side 1131' 5"
Curve on North side 1508' 7"
100.15
LEVEL
100.15
RISE 0.05 IN 100
101.00
FALL 0.05 IN 100
100.15
0
1131' 5"
1900
2640
3300
5280'

were next located by making the necessary right-angled measurements from the stakes planted on the mile line, the widths of the track being 70 feet on the home stretch, 55 feet on the back stretch, and 60 feet at the middle of each of the turns.

As the radius of each of the turns is 420.17 feet, and the width of the back stretch is 52 feet from the outside of track to the mile line, if a line C, D (shewn on figure 1, below), be run parallel with Macdougall Street, and distant 472.17 from its westerly limit, it will pass through the centres of each of the semi-circular arcs, and be equally distant from the parallel tangents. The centres E and F of the arcs were found by trial measurements, so as to place the track suitably with reference to the northerly and southerly boundaries of the field.

Next, the points A A′, B B′, where the tangents join the arcs, and which would be the P.C. and E.C. of the two curves respectively if there were no easement curves, were located by measuring the length of the radius = 420.17 from the points F and E at right angles to the centre line C, D.



A, B and A′, B′ are the tangents of the mile line = in length to E, F = 1320 feet, and A, D, A and B, C, B are the arcs of the semi-circles respectively = 1320.

Now, if the track had been laid out without easement curves, after staking out the tangent lines A, B and A′, B′ we would have located the curves by the method of deflection angles, as follows:

The deflection angle for a chord of 100 feet (see fig. 2) sin;

$$\frac{1}{2} D = \frac{50}{420.17} = .1189.$$

$\frac{1}{2}$ D = 6°50′ = deflection angle for a chord of 100′.

D = 13°40′ = central angle for a chord of 100′ feet.

As the number of minutes in 180° = 10800, and in 13°40 = 820′, the length of the curve measuring on 100′ chords

$$= \frac{10800 \times 100}{820} = 1317.03'.$$

The length of the curve measuring on arc = 1320.00′.

If chords of 25ft. in length be used with the proper deflection angle the measurement of the curve on 25′ chords = 1319.9 + or very nearly equal to 1320′, and since the rule in the measurement of race tracks is to reckon the measurement on the arc, we used chords of 25 feet in length in the preliminary location of the mile line, and 16 feet in length on the final location.

Owing, however, to the introduction of transition or easement curves at the beginning and end of each of the turns, the tangents are each shorter than 1320 feet and the curves correspondingly longer.

When a curve of a short radius joins a tangent it is customary in railroad work to introduce a curve of a larger radius between the tangent and the central curve, so as to make the change from the tangent to the curve less abrupt. Such a curve is called a transition or easement curve.

There are many methods given in the text books and in engineering magazines for setting out such curves, but we followed the method adopted by Mr. E. T. Muenscher, Manistee, Michigan, as explained in a paper read by him before the Michigan Engineering Society in 1891, and in a second paper in 1892, and published in their manual for those years, as they appeared to us to be best adapted for the purpose, and the most simple to use.

He deduced his formula for the easements from the equation of the cubic parabola, assuming the length of the easement to be 200 feet, or 100 feet approximately on each side of the P.C of the central curve.

As his method has been very fully explained in the above papers, which are within reach of any of the members of this Association who may happen to be interested in the matter, I shall not repeat his deductions, as it would make the paper too long, but shall only give the values of the deflection angle for each 25′ when D = 13°40, as previously explained. Let the origin or P.T.C. of the easement curve be at G (Fig. 1), then the deflection angle from the origin or the point G to the terminus at K (fig. 1) $= \frac{1}{3} D^\circ = \frac{1}{3}$ of $13^\circ 4c = 4^\circ 33'$, and the deflection for any intermediate chord varies as the square of the distance from the origin nearly, thus, the deflection angle for 50 $= \left(\frac{50}{200}\right)^2 \times \frac{1}{3} D^\circ = \frac{1}{48} D^\circ = 17$.

The deflections therefore for each successive chords of 25′ beginning at the origin and ending at K will be 4′, 17′, 38′, 1°08′, 1°47′, 2°34′, 3°47 and 4°33 respectively. After planting the stakes at each 25′ up to the terminus of easement at K, the angle $\frac{2}{3} D = 9^\circ 07'$ is deflected from the direction of G K to get the tangent K I to the central or circular curve, the total deflection being 13°40 at K.

In railway curves up to 8° or 10°, and when the total deflection seldom exceeds 90°00, it would be sufficiently correct to measure back 100 feet from the P.C. of the curve along the tangent to obtain the P.T.C. or origin of the easement curve, but in race tracks the error involved in doing so would be considerable, and should not be neglected.

The distance of P.T.C. from P.C. of the curve can be simply found as follows :

Referring again to (fig. 1),

The $< \mathrm{I\,K\,L} = 90° - 13°40 = 76°20 =$ also to $< \mathrm{I\,L\,K}$.

The $< \mathrm{K\,I\,L} = 27°20$.

The offset from the tangent at $\mathrm{K} = 200 \times \sin 4°33 = 15'.9$ approx.

$\mathrm{K\,L} = 840.34 - 2 \times 15\ 9 = 808.54$.

R′ = the new radius of the central curve with easements $= \frac{\mathrm{K.N.}}{\sin 76°20} = 416.05$, the central angle L E K - 152°40.

Length of the central curve $= \frac{2\ \Pi\ R' \times 152°40}{360} = 1108.58$.

Add 200 for each side for easements $= 1108.58 + 400 = 1508.58$, $2640 - 1508.58 = 1131.42 =$ length of each tangent with easements.

The length of the tangent without easements = 1320.

$\frac{1320 - 1131.42}{2} = 94.29 =$ G B = distance of the origin P.T.C. of the easement curve from the P.C. of the circular curve if there were no easements.

If we measure back 94′29 along the tangent from the point B to the point G or P.T.C., then set up the transit at G, and plant the stakes 25′ apart up to the terminus at K, using the deflection angle 4′, 17′, etc., up to 4° 33° as explained above, and, having set the last stake at K, the transit is set up over the point K, and the angle $\frac{2}{3}$ D° = 9°07 is deflected from the direction of G K to obtain the direction of the tangent K I.

The deflection for each 25 feet on the central curve from K = $\sin \frac{1}{2}d = \frac{12.5}{416.05} \therefore \frac{1}{2}d = 1°43', 17'$ nearly.

We then deflect 1° 43′, 17′ in succession from the direction of the tangent K I for each 25′, omitting seconds and reading to the nearest minute.

We ran in one-half the curve from each end, so as to minimise errors of readings or measurements.

Having in this manner located the curve at the south end, the curve at the other end being similar, was located in the same way.

After the grading was completed we again located the mile line, having previously referenced the principal points, this time planting the stakes 16′ apart, and calculating the necessary deflection angles for 16′ similarly to the above.

GRADES.

As the natural surface of the ground is almost level, the longitudinal grades are very light, as shown on the annexed profile. Commencing at the northwest turn, and going southwards, the track on the inside is level for about $\frac{1}{3}$ of a mile, it then rises .05 per 100, or about 10 inches for $\frac{1}{3}$ mile, and falls 10 inches for the remaining distance.

The transverse grades are $\frac{1}{10}$ of a foot per 10 feet on the stretches, and 1 inch per foot on the turns.

Around the easement curves, the grade of the outside of the track rises uniformly from the end of the straight course to the point where it joins the circular curve.

Thus, on the home stretch, the outside of the track = $\frac{7}{10}$ or $8\frac{1}{2}$ inches higher than the inside, and at the middle of the turns when the track is 60′ wide, the outside is 5′ higher than the inside.

GRADING.

The number of cubic yards of embankment on the stretches and turns was about 23,700, the material for embankments being obtained from the land adjacent to the inside of the track.

The surface soil, which consisted principally of clay loam, was first removed back, and afterwards used as a top dressing; the subsoil, which was of a stiff clay formation, was then used for embankment on the turns, and on the stretches where required.

The embankment on the outside of the turns was put on in layers of from 6 to 9 inches, each layer being thoroughly harrowed and rolled until unyielding and compact before the next layer was put on.

When the grading was made to within 6 inches of grade, the top dressing of surface soil was spread over the track, and thoroughly harrowed and rolled until the entire track was completed to the intended grade.

DRAINS.

Owing to the location of the ground, the drainage of the track and grounds was comparatively inexpensive, the outlet for the drains being the main sewer on Ouellette Avenue, the terminus of which is on the north side of Tecumseh Road.

The open ditches on the north side of Tecumseh Road and on the west side of Macdougall Street were enlarged and deepened to the required capacity, and an open ditch was constructed southwards along the west side of the track for about 600 feet, the remainder of the distance, down to a point near the C.P.R. lands being drained by an 8-inch tile drain. The interior of the track was drained as follows: An open drain was made through the middle of the enclosed land, and emptied into a catch basin near the northwest turn, which was connected with the open drain on the outside of the track by 10-inch sewer pipes, also an open drain was made all around the interior of the track about three feet from the inside fence, part of which had its outlet into the catch water basin already mentioned, and the remainder into two catch water basins on the east side which were connected with Macdougall Street ditch by 10-inch sewer pipe passing under the track.

FENCES.

Fences were built around the outside and inside of the course, and in addition a fence ten feet in height was built to enclose the necessary grounds, as shewn on the annexed plan and profile.

BUILDINGS.

The grand stand, which is 200 ft. × 36 ft., is placed so that its south-east corner is 30 feet from the outside of the track, and its north-east corner 40 feet. The wire, which is opposite the centre of the grand stand, is 405 feet from the commencement of the south-west turn.

The stables, which are not yet all completed, will accommodate about 150 horses.

The judge's stand is placed about 10 feet from the inside of the track.

The cost of the improvements is as follows:

57½ acres of land @ $300.00	$17,250 00
Grading, Ditching	6,370 00
Grand Stand	7,500 00
Fencing	2,800 00
Stabling and other buildings	5,000 00
Total	$38,920 00

The improvements and additions to buildings will bring up the cost to about $40,000.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

PHOTO-TOPOGRAPHY.

By OTTO J. KLOTZ,

O.L.S., D.T.S., Ottawa.

The subject that I have chosen covers too much ground for a paper before an association; however, as it is comparatively new, the rudiments may not be uninteresting to some of the members.

The application of photography to surveying has passed the experimental stage and has obtained a firm footing. To Canada belongs the honor of having made the most extended photo-topographic survey of any country in the world, and its development is due to Mr. E. Deville, Surveyor-General, Department of the Interior, Ottawa, who has also written an exhaustive treatise on the subject, but, unfortunately, it is not in the market. About 2,000 square miles of our Rocky Mountains have been mapped by this method by Mr. J. J. McArthur.

The camera used is especially designed for the purpose. It consists of a strongly-made, brass-bound box, and, as the views are always distant, there is no adjustment for focus. The lens is of superior quality, and gives a flat image, is free from distortion, and includes an angle of about 60 degrees. Its focal length is about $5\frac{1}{2}$ inches.

The glass plates are $4\frac{3}{4}''$ by $6\frac{1}{2}''$, and are isochromatic. In the camera and close to the plate are fixed four small brass combs, one in the middle on each side; as images of these are photographed onto the plate, they serve the purpose of providing traces of planes of reference—the horizon and principal lines—for orienting the views. Six shields, carrying a dozen plates, accompany the camera. The difficulty of photographing distant views arises in a great measure from the haze. This difficulty is to a certain extent overcome by inserting an orange glass screen behind the objective. Views 35 miles distant have been obtained with sufficient clearness to use for checking. At such a distance of course no detail can be obtained.

In order to obtain sharpness of detail a small stop or diaphragm is used, whereby the time of exposure is increased. It is placed between the two lenses of the objective.

The camera is provided with a level on top, for it is essential to have it well levelled; furthermore, to it can be attached a foot, fitting onto the tripod of the transit, which, it is scarcely necessary to say, is indispensable in photo-topographic work.

The transit used should be light and compact, and be provided with three-inch horizontal and vertical circles.

This comprises the necessary instrumental outfit ; an aneroid is however generally carried also. The country especially adapted for photo-topographic surveying is a mountainous one, and the more mountainous and rugged it is, the more are the merits of the camera over other methods for such regions shown. For this reason was the photo-topographic method chosen by the Canadian Commission for the work to be done in connection with the Alaskan Boundary.

The principles underlying the method are simple, and may briefly be stated.

For the present the focal length, the horizon line (the intersection of the horizontal plane with the picture plane), and the principal line (the intersection of the vertical plane, containing the optical axis, with the picture plane to which it is perpendicular) which are the constants of the camera, are supposed to be known ; the method of their determination will be shown hereafter.

Let the accompaning diagram represent a view, and on which are drawn the horizon line H H′, and the principal line P P′, O is the principle point. The principle point gives the " pointing " of the camera. Produce P P′ to F making O F = the focal length.

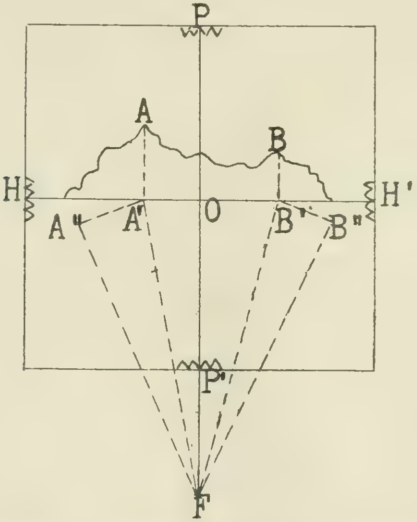
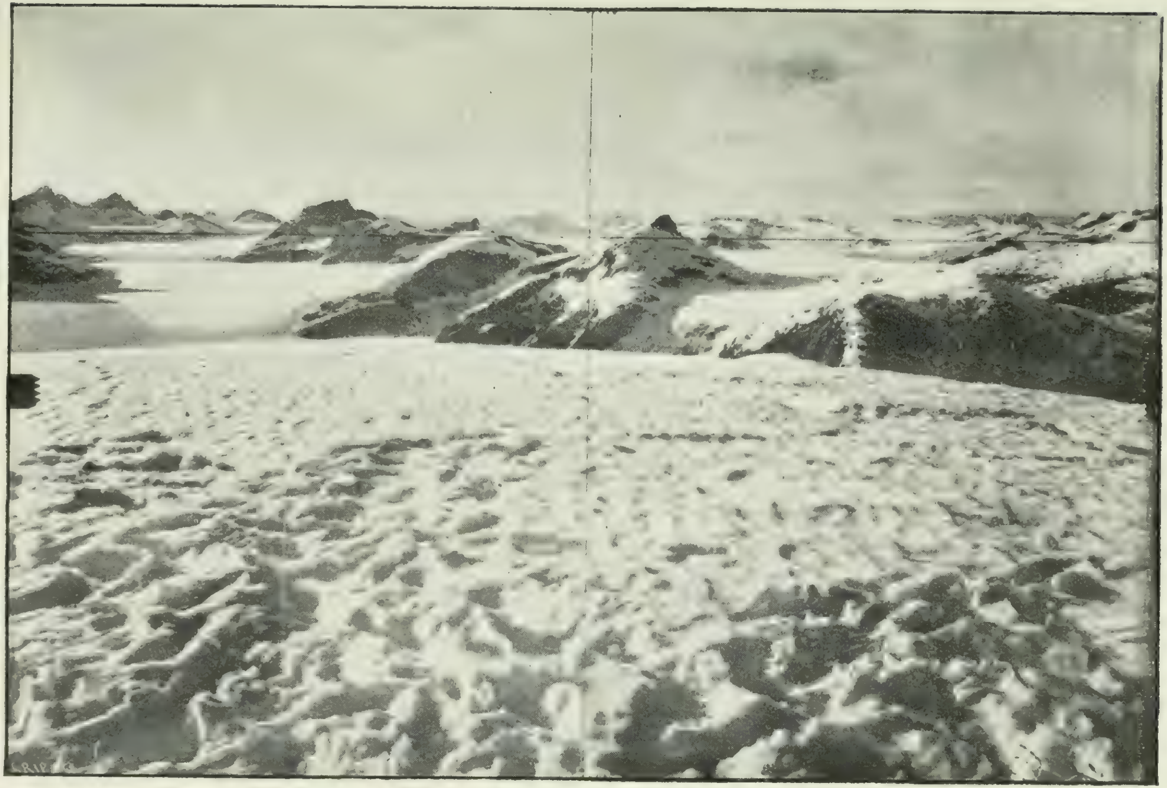


Figure 1

From the principles of optics and similar triangles we know that the horizontal distance of the image of the object from the principal point is proportional to the distance of the object from the optical axis in the ratio of the focal length to the projection of the distance of the object on to the optical axis ; and similarly the vertical distance of the image above or below the hoizon line is proportional to the vertical height of the object in the same ratio.

Hence in the diagram if A and B are two mountain peaks and we



View taken at an elevation of 4,200 feet on the west side at the head of Taku Inlet, Alaska, and looking westerly, showing Windom Glacier to the left and Foster to the right. Both glaciers reach the sea. The mountains on the sea shore show glaciation 4,000 feet high.

The photograph is by W. Ogilvie as the writer's are too large for insertion.

draw A A′ and B B′ perpendicular to H H′, and A′ A″ equal to A A′ and perpendicular to F A′; similiarly with B′ B″; F A′, F B′ will be the pointing of A and B and the angles A′ F O and B′ F O the azimuths from the line of sight, hence too A′ F B′ represents the horizontal angle between A and B as seen from the station, and corresponds to the angle, if read with the transit. Similarly the angle A″ F A′ and B″ F B′ are the vertical angles of the points A and B as seen from the station.

This is in short the essential principle of photo-topographic work, and by which the position of any point on a photograph is resolved into its horizontal and vertical components.

What concerns us next is, how to get linear measurements from the photograph. We will first determine the focal length of the objective. Set up the transit, and take horizontal angle reading on four or more points comprised within the angle of the camera, say on A, B, C, D, E (here in Toronto the University would be a very suitable object for the purpose), then photograph from the same station the points. The prints made from the $4\frac{3}{4}'' \times 6\frac{1}{2}''$ plates are enlarged to double that size. On a sheet of drawing paper describe an arc of say 70° with any radius, preferably a little greater than the focal length or rather, double the focal length, as the print is enlarged in that proportion. By means of chords lay off on the arc the successive horizontal angles and join the ends of the chords with the centre of the arc, as shown in the diagram (2), F A, F B, F C, F D, F E. Now lay a strip of paper on to the print and mark thereon consecutively the horizontal distances between the points. Next transfer the strip to the drawing paper and fit so over the radial lines that the points fall on their respective radii. After having found the desired position draw a line A′, B′, C′, D′, E′ for that position. A′ E′ is the trace of the picture plane on the horizon plane. Then the line F O drawn at right angles to A′ E′ is the required focal length. The graphical determination as above indicated, is simpler than the trigonometrical one. To find the horizon line we observe some verticle angles (say on the University) from the same station. These angles may be read at the same time that

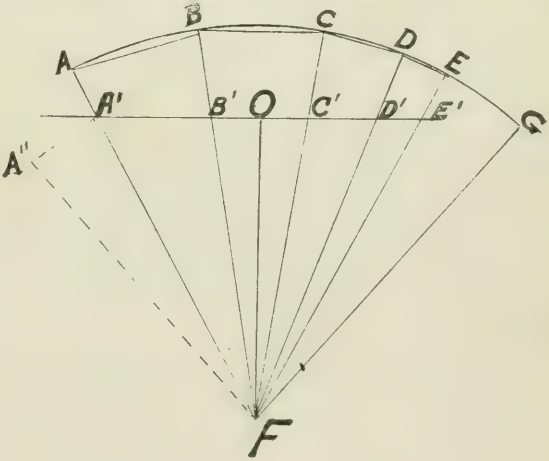


Fig. 2.

the horizontal angles are taken. Lay off at F (Fig 2) the angle A′ F A″ equal to the elevation (or depression) of A and at A′ erect the perpendicular A′ A″ to A′ F, then A′ A″ represents the linear measure of A above the horizon line. Similarly with the other points B, C, D. Hence if we lay off vertically on the print these measures from their respective points, the line passing through their extremities is the horizon line, H H′ (Fig. 1). Evidently two angles of elevation or depression are sufficient for establishing the horizon line, but it is well to take one or two more for checking.

The principal line is established by drawing from F (fig. 1) a line at right angles to H H′. The position of the distance point O, may be computed too trigometrically from the known focal length, the observed horizontal angle between two points and their linear horizontal distance apart on the print, and then, a line drawn through it perpendicular to H H′ for the principal line.

The horizon and principal lines once well established, we note their position on the comb-marks for future reference.

The skeleton or triangulation upon which the photo-topographic work is based is made with the transit. On a mountain summit horizontal and vertical angles are read onto prominent peaks, so as to have at least one horizontal angle for every view taken, of which there are generally seven at each station, so as to cover the whole horizon and allow a small lap of one view on to the adjoining one. It is well to take occasional solar or stellar azimuths during the season. The horizon and principal lines are supposedly constant, but each photograph has generally sufficient data to check, if necessary, their position.

From each triangulation station as plotted we lay off on the map the focal length in the direction of the pointing of each view and at the extremity draw a line at right angles to it, then on this latter line from the principal point lay off the horizontal distances of any point on the print (which we wish to locate) from the principal point; we thereby get the direction of the point from the station. Now selecting the same point on another photograph and from a different station, we proceed likewise. Evidently the position of the point lies at the intersection of the two lines giving its direction from the two stations. Thus as many points as can be identified on two photographs from different stations can be located. It is seen therefore that the location of points on the map is simply a graphical solution of triangles.

The focal length of a camera is expressed by a certain number of inches and bears a direct relation to the linear measures on the print, it follows that for the given scale of the map the vertical measure of a point above or below the horizon line (station from which the photograph is taken) on the print can be directly expressed in feet.

Having located as many points as possible for a certain area and having assigned to each its absolute height the drawing of the contour lines begins.

It may be stated that besides the stations on the summits, others called camera stations are taken in valleys or on mountain slopes for detail. The position of these latter stations is determined either by direct angular measurements or by photographs on known points from them.

On the Alaskan Boundary work the scale is 1 : 80,000 and the contour lines are drawn 250 feet vertical apart.

The work of a photo-topographer in a country like Alaska, midst jungles, precipices, rocks, snow and glaciers, is very arduous and dangerous. Fortunately no serious accident occurred. Ascents are made at the rate of about a thousand feet an hour. Every climber carries the indispensable alpenstock. Every party had a Mackinac boat for shifting camp and also a Peterboro' canoe. The tides were new to some of the men and by experience thay learned that camp pitched on dry land in the evening may be found in Venice by midnight. The parties consisted of six, all told. The most covered by any party was about a thousand square miles : however, if much detail is required 500 square miles represents a good season's work.

In south-eastern Alaska, where it rains five or six days every week, and where fogs are prevalent in an almost constantly saturated atmosphere, great care must be exercised in keeping the plates dry, for which purpose air and water tight tin boxes holding two dozen plates each are carried. There were about 700 photo-topographic views taken, covering an area of nearly five thousand square miles.

The accompanying view gives a faint idea of the rugged and arctic nature of the country as seen from a mountain peak.

At the sea level the temperature during the year is not subject to as great fluctuations as on the Atlantic sea-board, and besides the average is higher. The mean winter temperture of Sitka is nine degrees higher than that of Halifax, although the latter place is nearly 900 miles farther south. During the past summer I found the mean temperature to be about 54° F. One of the arms of the sea into which glaciers discharge was found to have a temperature of 36° F. Pretty cold for sea-bathing!

In closing I will just state that topographers are not born but made, and by years of training and experience.

It would astonish many of you to see an expert identify some points on one photograph with those on another print from a different station; not mountain summits, which are comparatively easy to recognize, but patches of snow, dark spots of rock and the like.

I believe you have a man here in Toronto who is just on the eve of finishing a practicable flying machine. I would respectfully request our secretary to send his address to the Alaska Boundary Commission, Ottawa, as soon as the machine is completed, for thereby sole-leather and ejaculations would be saved.

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CEDAR, MACADAM AND GRAVEL ROADWAYS.

By P. S. GIBSON,

O.L.S., C.E., Willowdale.

Of the many important public questions of the day that of "Good Roads" is becoming of Provincial interest, as lately shown by the meeting in this building of representatives of most of the counties of the Province.

I need hardly state that drainage is the most important requisite of a good road, and yet there is no statutory provision by which a corporation may make suitable ditches at proper distances from the centre line of the roads, but on the contrary, if such ditches be made and a careless driver, or a good driver with a vicious horse, or a drunken driver with any kind of a horse, should meet with what is called an accident by driving into such ditch, the corporation soon learn that a plea by the corporation of contributory negligence on the part of such person is not a suitable defence, and travellers have a legal right to travel on any part of the public road, and that a ditch is in a legal sense an obstruction. I have thought that by an appeal by the corporation to the Ditch and Watercourses Act, or the Drainage Act, by which all persons owning lands adjoining public roads would be compelled to aid in the draining of the same, would be advisable, but such Acts would not, I am of the opinion, relieve the corporation from damages in the case of a so called accident ; but they should, and all doubt should be removed by an amendment to those Acts to that effect, or to the general Municipal Act.

As good roads cannot be made without good drainage, and as there is no statutory provision for securing good drainage free from actions for damages by the travelling public, and again as under English practice or law, water cannot be taken from an extraneous source and discharged upon land where it would not naturally flow if the lay of the land was the same as in a state of nature, it is readily seen that we have a very difficult problem to solve in attempting to secure good drainage for public roads. I think the law and the cases decided on the same are clear that while water falling upon land from above may have its natural flow, assuming the lay of the land to be as in a state of nature, yet neither an individual or corporation can collect the water so falling or springing and discharge it in a body upon public or private lands, except in cases provided for under the Ditches and Watercourses Act or Drainage Act.

I am engaged now in a case where water has been for a long time flowing into and down a ravine from the public road, and the only artificial drainage from the public road to the ravine is a ditch dug by the owner at one time when pathmaster, about 33 feet in length, to let the water across a corner of his lane into the ravine. The present owner, son of said owner, now, under instructions of an eminent legal firm in Toronto, has filled up said artificial short drain and demands damages for past years' flooding and security against future damage, amounting to the modest sum of over two thousand dollars, in case the water continues to flow. Now as the discharge into and down said ravine is the really only practicable route for the water according to the usual practice of country road making, the corporation will require to invent some new method of road-making, should the plaintiff succeed in his claim, as this is not the only one, but there are many others of a similar kind now pending. So may it not be conceded that while the township and county councils are being continually urged to make good roads, and are anxious to do so,, they are practically precluded from doing so. Since a good road must be drained by open ditches, which should be, if possible, three feet in depth below the crown of roadway, and ditches of this depth must and do draw water from extraneous sources, and do discharge water on lands where it would not naturally flow, as we have actually artificial and not natural drainage, and ditches of such dimensions must to some extent be dangerous to careless, reckless and drunken drivers and at times to the most sober and careful.

If correct as to the legal difficulties in the way of securing good drainage, some simple and quick procedure should be obtained by statute to secure when required such drainage, even if in some cases individuals may in their opinion suffer for the general good. This should not, in the present age, be difficult to obtain, when in the supposed public interest quick transit is considered a necessity. Electric cars and with double tracks are permitted to pass along the crowded streets of our cities and towns at a speed frightful to witness, and often causing death to both man and beast, and telegraph, telephone, electric light, and trolley poles are crowding each other in our public roads, and even encroaching on the turnpiked portion, all as pretended in the public interest.

Assuming that we have the right to drainage, we have still grave difficulties to overcome. In a climate where the frost often penetrates to over four feet in depth and the subsoil cannot even with the best of drainage be kept free of water, either by absorption from below, or by penetration from above, on account of deep ruts often in the road covering or on account of the shallow metal covering; in the spring particularly when the frost is, as we say, coming out of the ground. the road bed beneath the macadam or gravel covering becomes like a bog, and, as I have often seen on Yonge street, the macadam crust on top breaking through, letting the wheels pass to the hubs into the roadway.

A roadway in such a state, which is not uncommon for our best macadam roads, soon under the pressure of heavy travel, shows the mud gradually pressing upwards through the stones or gravel and the stone or gravel rapidly passing down into the mud, and thus leaving a roadway a mixture of mud and stone, or mud and gravel, as the case may be, and often, so far as the casual observer can see, in the end only a fair earth road It is evident, therefore, that a good road, the same as any other good structure, must have a good foundation, and that the foundation must, so far as practicable, be properly drained.

To secure this object various methods have been employed. The good old Roman method of filling in a trench to some feet in depth in some cases with boulders for a foundation, or the Telford system, where a pavement of stone set on end and fixed permanently by wedging with smaller stone, or by laying a bed of large flat stone carefully fitted together, and solidly rammed and spaces between filled in with smaller stone, or the good old frontier method of letting down the corduroy roads of cedar or other logs into the swamp soil below, and then ditching the sides and covering the logs with clay to a suitable depth before putting on the macadam gravel.

In my practice in constructing roads under the Local Improvement system, where the petitioners were applying or about to do so for the cedar block pavement, I have recommended them to adopt a kind of roadway which may be called a cedar, macadam and gravel roadway, which may be considered the subject of this paper.

In constructing this roadway I first make a profile and sections of of the road, and having fixed the grade lines both longitudinally and transversely, I receive tenders, if there is much excavation, at a rate per cubic yard for excavation, and at a rate per lineal rod for the cedar, macadam and gravel, all laid complete in the roadway. I find the cost about the same as for cedar block roadway.

The specifications for the cedar, macadam and gravel provides that for cedar, that it shall be of round cedar posts, at least 6 inches diameter at the smaller end inside the bark, that they shall be laid at right angles to the centre line of the road in straight or curved lines as the case may be, that they shall fit tight together and be bedded solidly in the earth bed of road and earth rammed tight under and between them, and to a height of about one inch over the tops of logs and consolidated so a buggy or wagon may be driven rapidly over them with ease and comfort, the tops of the logs to have a uniform surface, and so laid that no movement among the logs will take place when driven over before the macadam is put on. In some cases the cedar logs are laid only to the width of one post 9 feet long, which is quite wide enough for an ordinary roadway. In other cases I have two courses of posts 8 feet in length each, thus giving a sixteen foot roadway, the posts butting at the centre of road. The advantage of using round posts is that they bed better and are less liable to move, but provision is made, in case round posts cannot be got, the contractor may use split posts, which as well as the round posts must be straight, but in case split posts are used, they must be at least 7 inches in diameter at any place at the smaller end, and when laid must be lapped by alternately putting flat side down and then the round, and as in case of the round posts, must be laid to make a solid road before the macadam is laid on.

My idea of using cedar posts for the foundation of the macadam was that I could get any amount of second-class cedar, as so much first-class was required for cedar blocking, and that a second-class would answer my purpose about as well. This second-class cedar I provided should have an extra diameter in case of large " pin holes," or partially decayed parts, but in no case were rotten posts allowed, but generally those were used that would not do for cedar blocks or fence posts, and on that account were got very cheap by the corporation. Burnt posts were also allowed.

Upon the cedar foundation thus prepared I had placed macadam 6 inches in depth to be rolled and consolidated. I usually have the contractors haul the boulders (good, hard field stone, no limestone allowed where heavy traffic is to be expected), and have them hand-broken on the cedar, as I found it was generally cheaper for the contractor and resulted in having the cedar and clay covering completely consolidated. I required the stone in all cases to be hand-broken, as I consider the machine-broken stone to be inferior on account of being, to some extent at least, generally damaged throughout by the crushing power used to break them, and therefore more likely to disintegrate under influence of travel, and the effect of frost and water, and from other causes. The stone I required to be broken as nearly as possible to a cubical form and to pass in any direction through a 2½ inch ring. I preferred them to be rather on the large size for a new road.

Upon the macadam thus laid and rolled and consolidated, all work done under the superintendence of a skilful inspector, I had a cover of 3 inches in depth above the tops of the stone, put of good, select gravel, not over 2 inches in diameter, which was to be evenly spread and rolled with a heavy iron roller to the satisfaction of the engineer.

By the terms of agreement the contractor has to keep the road in repair for three months after completion, to insure which from 10 to 15 per cent. of contract price is retained. During the three months the ruts are to be kept filled in and any large stone coming to the top to be broken or re-imbedded, and road to be kept smooth and even. These roads have generally a turnpiked width of about 30 feet, *i. e.*, 15 feet from centre to bottom of water-tables, which ought to be about 15 to 18 inches below crown of road. I prefer the cross-section to be of an elliptical form. Where the cedar is laid only 9 feet wide, there is a good earth drive on each side.

In all cases I would prefer to have land tile drains put in these roads, not only under centre of road, but beneath each water table, but it is difficult to get a proper discharge to these tiles in a flat district, and where the land is rolling they are not required so much, and I then put in a good sharp ditch at about 16 feet from centre on each side and taking care to get good, clean discharges and putting in good 6′ × 6′ or 8′ × 8′ squared cedar culverts at every natural run or old ditch or watercourse I find on the roadway,so as to make sure of good drainage in the future.

The cost of these roadways is about 80 cents per square yard, where no excavation beside the necessary trench for cedar and ordinary water tables is required. If deep cuts are to be made, the contract price for excavation laid in embankment for ordinary hauls, if soil is of clay, about 15 to 18 cents per cubic yard. For cedar culverts cedar being sawn and say 6′ × 6′ or 8′ × 8′, about $20 per M, board measure, laid in the work all complete, including iron drift bolts. Should bridging be required I generally pay at a rate of $22 per M, board measure, for pine lumber, including stringers, if short spans ; and if piles required, at the rate of 25 to 30 cents per lineal foot driven, all complete in the work, and for iron say from 5 to 6 cents per lb.

The said roadway as completed by rolling during wet weather and having the ruts carefully raked in, soon becomes a smooth, hard road without having the macadam exposed for months to the action of vehicles to consolidate them, as is done in some roads where no gravel or covering is put on and rolled down upon and into the openings of the macadam, and thus leaving the macadam to be either ground into powder or round pebbles, which form a bond with difficulty.

I need hardly say that the cedar post foundation of this roadway will last for a long time, and is a good protection for the macadam from the earth or mud if it forms beneath, and that the smooth surface on top caused by the gravel covering, makes the water flow readily off the road surface, and also that the roadway thus completed forms an excellent drive for not only heavy waggons but for carriages, and is easy on the horses feet, which cannot be said of an ordinary macadam road or asphalt, brick or granite sets, and also suits the bicycle well.

On one occasion an application was made to the corporation for a Local Improvement of a roadway, and I found on examination that the soil was a hot dry sand of such character as to in a short time cause the destruction of any wood with which it came in contact, so that instead of recommending the cedar blocking the petitioners were desirous of proposing, I suggested that the road should have a flagstone foundation of large Humber stone firmly bedded in the roadway and wedged in with smaller stone. Upon this foundation I had from 6 to 8 inches of good screened gravel laid and rolled and consolidated and all large gravel stone broken. This roadway cost at the rate of about 35 cents per square yard for stone and gravel laid complete, and excavation, of which there was a considerable quantity, cost at the rate of 12 cents per cubic yard. The roadway was a very cheap one and has given great satisfaction, and, I believe, will last for a great many years, whereas a cedar block would have become dilapidated in a short time and a nuisance and a cause of danger to the public and would have cost much more. Of course a cedar post foundation would not have answered in such a locality.

In this paper I have tried to state:

1st. The necessity of good drainage.
2nd. The legal difficulties.
3rd. That a good foundation is necessary.
4th. The kind I have adopted in some cases.
5th. The class of roads known as cedar, macadam and gravel.
6th. The flagstone and gravel road.

I would have been pleased to continue the paper to consider other kinds of roadways with the advantages to each, and localities where applicable and cost of same, but it would make the paper too long.

DISCUSSION.

The Chairman—This is a very interesting paper and certainly provides a novel way for making the foundation for macadam. It seems to me it is also a very ingenious and a very efficient way. We all know that timber buried in the ground and excluded from the air where it can be kept saturated will last almost forever. On the one hand, timber, if it is kept perfectly dry will last forever, and on the other, if it is kept perfectly wet it will last forever ; it is between the two conditions that it rots so quickly. And I fancy that if it were as spoken of by Mr. Gibson it would be kept permanently damp and excluded from the air and would last a very long time.

Mr. Tyrrell—How long has this road been down ?

Mr. Gibson—There are roadways of the same kind in Yorkville put down 15 or 20 years ago and the cedar is still there.

Mr. Tyrrell—Do you find that there is no movement of the stone upon the cedar, that it forms a solid bed on the cedar ?

Mr. Gibson—The spaces between the logs behind them form a grip, as it were, and the stones are never worn. It does not do to use gravel of any size, use selected gravel with clay, if possible, among it ; that forms a bed and a very tight cover.

The Chairman—There is another point that Mr. Gibson draws attention to, that is that in his wooden bridges he uses very small scantling so that they dry out thoroughly. I know about 10 or 12 years ago I was asked to report on a bridge built in 1840 and to prepare plans for an iron bridge to take its place, and after a careful examination I found the timber was perfectly sound. I told them to reshingle the roof—it was one of these bridges with a roof on it—and they did so and it is as good to-day as it was in 1840, when it was put up, and it is good for 40 years more I have no doubt. In another instance of a somewhat similar kind in London, 150 years ago, a bridge was built of oak and it was taken down last year to provide for increased width, and every stick of oak in it was perfectly sound. I saw a cane made of it and it looked as if it were cut a few days before. It was protected from the water, and that is the secret of the whole thing. I have no doubt if you protect it from the water it will outlast iron, because municipalities as a rule do not paint their iron bridges at all, and if they do they paint them with the rust on between the iron and the paint, so the paint peels off and the bridge is rusted out in 25 or 30 years. I think Mr. Gibson ought to give us a paper on wooden bridges for next year.

Mr. Gibson—In some bridges I was rebuilding that had been built of 12 x 12 or 12 x 14—stuff that will last only 12 or 14 years—I arranged to cut up all the timber fine and put galvanized iron between the joints ; that was in 1878, and this year I found the joints where I had the galvanized iron just as white as the day I left them. There was not the least sign of decay.

The Chairman—How would Portland cement do ?

Mr. Gibson—Well, if you keep the water out. Then I built two or three large bridges and covered the upper portion of each truss with galvanized iron in such a way that the water cannot get into them. On the sides they don't require it. All the joints were covered in the same way, and my impression is those bridges will last 25 or 30 years, and they have been built since 1878.

Mr. Traynor—Do you find any difficulty with the frost raising the cedar in the road bed ?

Mr. Gibson—Oh no ; if it does it just goes down again. With these macadam roads in some places it becomes a perfect bog in the spring ; it is soft below and the stone goes down and the mud comes up and there you have your road.

Capt. Gamble—Do you have the ditches you speak of on the road side of the fence ?

Mr. Gibson—I put them about 15 or 16 or 18 feet from the centre of the road and let people run the risk of it.

Capt. Gamble—In the old country they generally put the ditches on the field sides ; in some countries they would not be allowed to put them on the roadside.

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PROTECTION OF THE SOURCE OF THE OWEN SOUND WATERWORKS SYSTEM.

BY R. McDOWALL,

O.L.S., C.E., Owen Sound.

THE Town of Owen Sound, lying as it does in a narrow valley surrounded by ranges of hills from two hundred to three hundred feet in height, from which issue numerous large clear springs of water, is particularly well situated as regards a system of water supply by gravitation. There are three springs of sufficient elevation and volume, in close proximity, to supply a city with a population of twenty thousand—one in the east on Lot 16, concession 10, in the Township of Sydenham ; another in the south on Lot 11, concession 2, in the Township of Derby ; and another, the present source of the waterworks system, in the south on the road allowance between Lots 12 and 13, concession 2, in the Township of Derby.

In the year 1878 a private company received the franchise from the Corporation for the laying and operating of a system of waterworks for the town, the Corporation retaining the right after ten years of buying out the system from the company at an arbitrated valuation.

The spring chosen for the source of supply of the system was the one before mentioned on the road allowance between Lots 12 and 13, concesion 2, in the Township of Derby, some two miles from the centre of the town. One of the reasons for the choice of this spring was that the water was a mixture of hard and soft, making a water fit and useful for both drinking and washing. The temperature of the water reads 38 degs. Far. in winter and 43 degs. in summer. At the site of the source the rock is very abrupt, about twenty feet in height, and from several crevices in the rock near its foot the water gushed out, and, previously to its being confined, ran down the hill in a natural ravine, finding its way to the River Sydenham. In order to gather the several streams which flowed from the numerous crevices in the rock, an excavation was formed in the face of the rock to the depth of three feet and of sufficient length to enclose all the streams. Along the mouth of this excavation a stone wall was built enclosing a sluice-way some two feet square, which led to a perpendicular penstock at the bottom of which the water-pipe was laid.

The water main laid by the Company was six inches in diameter, and led from the penstock at the source at an elevation of one hundred and seventy five feet above the town datum to a reservoir on the east hill, the elevation of overflow being one hundred and sixty-feet above datum.

In the early part of the year 1890, the town after considerable dealing bought out the entire system from the private waterworks company for the sum of fifty-five thousand dollars, and since that time the town has controlled the system. The same year the town laid a ten-inch main from the spring to the town and along the principal streets.

While under the control of the Company the water from the taps had occasionally been roily, but in June, 1890, after a very heavy rain storm it was muddy, the sediment resembling yellow clay. On investigation it was discovered that the field at the south-east part of Lot 13, concession 3, had been recently ploughed, that its subsoil was a yellow clay, the water in the ditch along the side road into which this field drained was of a yellow color. This ditch ran east along the road side and turned into Lot 13, concession 2, and emptied into a sink hole, a large crevice in the limestone rock. In all probability this sinkhole had underground connection with the source of the waterworks, as the water at the spring was of the same color. In order to test if there was a connection between them, a quantity of oats, sawdust and corkdust was put in the sink hole at several separate times. A fine wire screen was placed over the waste weir at the penstock, but out of all the quantity placed in the sinkhole only a few grains of oats found their way to the screen.

In the summer of 1891 a suit was instituted against the Corporation of the Township of Derby by the Corporation of the Town of Owen Sound for an injunction restraining them from draining their road allowance into the sinkhole before mentioned, under Clause 18, chap. 28, 31 Vic., of their private waterworks Act—" If any person, etc. * * * * * * cause, permit or suffer the water of any sink, sewer or drain, to run or be conveyed into the same (that is, source of waterworks) or cause anything to be done whereby the water therein may be in any way tainted or fouled, etc."

The corporation of the Township of Derby, after some preliminary attempts at a peaceful settlement, decided to defend their case, and it came up for trial in the full Chancery Sittings before Justice Robertson.

The writer was employed on the side of the defence, whose object was to prove :

(1) That the sinkhole, together with numbers of others, formed the natural outlet of a large district of country from time immemorial.

(2) That they had prior rights of drainage, the ditch leading to sinkhole having been constructed some twenty-three years previously, or ten years before the penstock was constructed.

(3) That the plaintiffs were trespassers on the property of the defendants, having constructed their penstock and utilized a spring of water on their road allowance without obtaining permission of any kind or paying one cent of compensation.

While making a survey of the surrounding lands the writer discovered no less than thirteen sinkholes, one of which had as large a stream of water entering it as the one concerned in the suit. These sinkholes are just crevices in the limestone rock. Across Lots 12 and 13, concession 2, about 20 chains from concession 2 and 3 road allowance, the limestone rock is abrupt and rises to the surface of the ground, thence westward. The surface of both the rock and soil surface dip downward and at ten chains from the abrupt rock is from three to four feet below the surface of the soil, and here the sinkholes occur; from thence westward the ground surface rises.

In order to have a case the plaintiffs had to prove positively a connection between sinkhole and source of waterworks system. In order to make a test a gallon of phenyle was obtained. Phenyle when mixed with water assumes a milky white color, and its smell and taste are very objectionable. As there was very little water running in the ditch at the time a dam was placed across it in order to collect a sufficient quantity of water to cause a good flush. In this reservoir the phenyle was mixed; the dam was taken away and the milky disinfecting fluid was sent on its errand of subterranean discovery. The town engineer and his two witnesses walked leisurely down to the spring some 1,500 feet distant from the sinkhole and patiently waited for the appearance of the phenyle. Fifteen minutes passed, then thirty minutes; they grew impatient; at forty-five minutes a perceptible smell of phenyle was noticed and in a short time the milky water bubbled from the spring and ran into the penstock. Unfortunately the valve between the source and the town main was not turned off and the phenyle ran onwards to the town. This was about 1 o'clock p.m., and at 6 o'clock p.m. all water takers in the town were extremely live witnesses to the fact that there was a connection of sinkhole and spring. Many amusing anecdotes are told of the scenes at the supper tables when tea was served, and 'tis said that the whiskey at one of the hotels tasted of phenyle three months after; of this the writer knows naught, but he remembers his tea. The color, smell and taste disappeared from the water during the following day after having disinfected both water and sewerage systems of the town.

The tenor of Justice Robertson's judgment against plaintiffs in the case was as follows:—That the plaintiffs were trespassers on defendants' lands and had no rights to the spring; that the defendants in digging the ditch leading to sinkhole were only improving their roads as they had a perfect right to do. The Corporation of the Town of Owen Sound then appealed to the Divisional Court against this judgment and it came up in that court before Justices Galt and McMahon, who upheld the former judgment.

The evidence brought out by the trial showed the great danger the town was in from contamination of its water supply. An infectious disease such as typhoid fever or diphtheria might at any time become prevalent in the area drained into the sinkholes and germs of disease find their way into the town. As an example of such danger, see *Engineering News*, April 2, 1892: "The epidemic at Plymouth, "Pa., is doubtless more or less familiar to our readers, as it is cited in "connection with nearly every discussion of typhoid epidemics in "this country. It occurred in 1885 in the six months, April to "September inclusive, there having been one person taken sick in "September, 15 in August, 81 in July, 83 in June, 261 in May and "713 in April. In all there were 1,104 cases in an estimated population of between 8,000 and 9,000. Of the 1,104 cases, 114 or over 10 "per cent. were fatal.

"This epidemic has been traced to the dejecta of a single typhoid "patient, which began to accumulate early in January, and remained "upon the frozen ground and snow until March 26th, when the first "thaw began, lasting until April 4. The dejecta, or some of it, was "carried down a stream to the reservoir supplying the town with "water, which had not been drawn upon during the winter, but was "begun to be used the first day of the thaw. The general sanitary "condition of Plymouth was very bad and doubtless accelerated the "epidemic greatly."

But in order to obtain some relief from the danger of pollution (it must not be misunderstood that the water was at any time undrinkable ; at its very worst it was slightly roily, but well tasting, as the surface water which found its way to the spring was free from pollution) the Waterworks Board purchased some five acres about the sinkhole and one half acre about the spring. In the summer of 1893 the Waterworks Board employed the writer to report upon some remedial scheme. Two schemes presented themselves—one to filter the drainage water, and the other to construct a ditch to carry off the drainage water to a point below the spring. The variable quantities of water and the cost were the main objections to the first scheme, and rock cutting and caulking of crevices in the limestone rock the difficulties in the second. The Board of Waterworks decided to construct a ditch some twenty-two hundred feet in length. The greatest depth of rock cutting was four and one half feet, and its amount some two hundred and forty cubic yards; the amount of clay being seven hundred and sixty-six cubic yards. Wherever crevices occured in the rock they were to be filled and packed with broken stone, then a six-inch layer of blue clay, upon the top of the clay a layer of cement mortar in proportion of one to one. Tenders were called for and the work was let late last fall at 95 cents per cubic yard for rock and 26 cents for clay, amounting to the sum of four hundred and twenty-seven dollars. The excavation was completed in November, but as the frost had set in it was not deemed advisable to fill the crevices in the rock until next spring. In the meantime, after every thaw the water finds its way in the "new sinkholes" to the spring, but it is hoped that by next May, Owen Sound can depend upon the source for perfectly pure water.

DISCUSSION.

The Chairman—It has always struck me that a filter is an uncertain instrument ; you cannot be quite sure what it will intercept. It may clarify water but it does not purify it.

Mr. Gibson—I had a case in filtration. I was requested to prepare a sewerage system for part of the township of York. They were determined they would have a system put in. It was very difficult to get rid of the sewage, so I proposed to filter it. Instead of filtering it as is usually done, that is, allowing the stuff to pass downwards, I have a settling-basin formed, passing through screens, and then the sewage has to come upward, and what is called the upward system works a great deal better and purifies the water more perfectly than downward filtration, because the downward is apt to carry matter with it but the upward leaves it behind. You have often noticed in a swamp that the water is beautifully clear and you can drink it with perfect safety, because the water is coming up, but if it were going down it would be apt to carry the impurities with it. So I would do the same with sewage. All the sewage is poured into this reservoir and it passes downward. When it pours into the first chamber it works up a lot of quicklime in a box—quicklime is kept there all the time—and then it passes down through a screen that catches any paper, etc., that may be in it ; then it has to rise and the filter in the second chamber is formed of slats of wood one inch apart ; upon that is an inch of gravel and then the whole is covered with quicklime. The sewage has to come upwards, and it works remarkably well. There is very little smell, and the water when it reaches the creek below is practically pure so far as the eye can see, but of course the germs may be there.

APPENDIX.

BIOGRAPHICAL SKETCH OF DAVID WILLIAM SMITH (BARONET), SURVEYOR-GENERAL OF UPPER CANADA, FROM 28TH SEPTEMBER, 1792, TO 10TH MAY, 1804.

DAVID WILLIAM SMITH was born on the 4th of September, 1764, and was the only child of John Smith, Esquire, sometime of Salisbury, Lieutenant-Colonel of the Fifth Regiment of Foot, who died commandant of the fortress of Niagara, Canada West, in 1795, by Anne, daughter of William Waylen, Esquire, of Rowde Hill and Devises, County of Wiltshire.

At an early age he was appointed by Earl Percy as Ensign in his father's regiment, and subsequenly obtained the rank of Captain, when his aptitude for business in the civil department so manifested itself that he was induced to leave the regular army and enter upon a course which afforded scope for his unusual talents. Although he relinquished his position in His Majesty's regulars, Mr. Smith did not abandon a military career, and held at various times the following offices in the militia, viz. :—Colonel of Lincoln Militia, Colonel of 2nd Battalion York Militia, Canada, and Lieut.-Col. of the Percy Tenantry Riflemen, of Northumberland, England.

On the 27th of August, 1792, Mr. Smith was elected a member of the first Canadian Parliament, and was re-elected to the two succeeding Parliaments.

As a member of Parliament, in which capacity he served his country for twelve years, his abilities made him one of the most distinguished men of his time, and he was chosen Speaker to that body in 1797, and re-chosen in 1801.

Called to the bar on 7th July, 1794, he bore, at various times, the titles of Deputy Judge Advocate, Justice of the Peace, Judge of the Court of Requests, Master in-Chancery and Privy Councillor.

Upon the passing of "The Constitutional Act," 31 George III., Cap. 31, by which the original Province of Quebec was divided into Upper and Lower Canada, Mr. Smith was appointed the first Surveyor-General of the Province of Upper Canada (28th September, 1792), and continued to serve in that capacity until ill-health compelled him to resign, which occurred on the 10th of May, 1804.

Having been from his boyhood known and honored by the notice of the Duke of Northumberland, Mr. Smith, upon his return to England, was appointed by His Grace as commissioner, auditor and general receiver for the Northumberland estates, which position he successfully filled for the remaining thirty-two years of his life.

During this time he also held many prominent public offices, and on August 30th, 1821, as a recognition of his many services in the new world as well as the old, he was created a baronet.

Sir David was twice married, first, on November 3rd, 1788, to Anne, daughter of John O'Reilly, Esquire, of Ballykilchrist, County of Longford, Ireland, and by that lady, who died in 1798, he had issue seven children, three of whom died young, one son, David William, of H. M. ship "Spartan," was killed at Quiber, and three daughters who survived him.

In 1803 Sir David married Mary, youngest daughter of John Tylee, Esquire, of Devises, banker, by whom he had one son and one daughter.

He died near Alnwick, in the County of Northumberland, England, on May 9th, 1837, in the 73rd year of his age.

His personal property and books after his death drifted into the hands of strangers, but by a fortunate accident, which the watchfulness and energy of Mr. Bain, the librarian of Toronto's Public Library, turned to good account, about twenty-five volumes of manuscript recently fell into the hands of that institution, and these contain records and information of much value to surveyors as well as antiquaries. Among the more interesting of these may be mentioned, a book of plans and descriptions of various properties in this province acquired by Sir David during his residence here, also the first lithograph map of the province, published in London, England, in 1800, from data furnished by the Surveyor-General for that purpose. This map is accompanied by a volume descriptive of the topographical features and settlements of the province. There are also maps of Toronto, Niagara, Duffin's Creek, and others of the more prominent hamlets of one hundred years ago.

Already the plans and maps referred to have been found of great service in boundary disputes, and, with a view of giving to those interested in such matters an idea of the localities touched upon, a schedule of the properties is copied and appended hereto.

Another interesting volume is entitled "Duplicates of Original Papers, showing the manner in which the land granting department was conducted on the first settlement of Upper Canada, with the forms of proceeding, and several subsequent minutes." A volume of miscellaneous matter includes instructions to deputy surveyors, a statement of the contents of the Surveyor-General's office on 1st July, 1802, numerous autograph letters from Chief Joseph Brant, relative to the surrender of territory by the Six Nations Indians; also papers relative to the militia and the lieutenancy of the County of York.

The numerous appointments received by Sir David during his public career were arranged by himself, in order of their dates, and are given below :—

A MEMORANDUM OF THE DATES OF THE HON. D. W. SMITH'S APPOINTMENTS.

Ensign in the 5th Regiment of Foot	8th Sept., 1779
Acting paymaster to same	8th Sept., 1780
Secretary of the Land Board, Detroit	4th June, 1790
“ to the Commandant, “	“ “
Fort Adjutant, “	“ “
Assistant Engineer “	1791
Deputy Quarter Master General, Niagara	12th April, 1792
Secretary to the Commandant, “	12th June, 1792
Member of first Canadian Parliament	27th Aug., 1792
Justice of Peace	“ “ “
Surveyor General of Lands	28th Sept., “
Deputy Judge Advocate	8th Oct., “
Member of all the Land Boards	27th “ “
Vice-President of Agricultural Society	“ “ “
Articled to the Attorney-General	2nd June, 1793
Called to the Bar	7th July, 1794
Major to Provincial Horse Artillery	18th August, 1794
Captain in the Fifth Regiment of Foot	2nd Sept., 1795
Privy Councillor	2nd March, 1796
Deputy Lieutenant for County of Lincoln	1st August, “
Member of 2nd Parliament	18th “ “
Colonel of Lincoln Militia	7th Jan'y, 1797
Judge of the Court of Requests	“ “ “
Speaker of the House of Commons	7th June, “
Commissioner for Examining Public Offices	12th August “
Trustee for the Six Nations Indians	10th Oct., “
Colonel of York Militia, 2nd Battalion	1st June, 1798
Lieutenant of the County of York	3rd Dec., “
Master-in-Chancery	17th July, 1799
Member of 3rd Parliament	Aug., 1800
Re-chosen Speaker	June, 1801
Commissioner of Growth of Hemp	28th July, “
Commissioner for Administering the Government	1st Sep., “
Resigned my appointments, and a pension settled for my services	10th May, 1804
Commissioner, Auditor, and General-Receiver to His Grace the Duke of Northumberland	10th May, 1805
Lieut.-Col. of the Percy Tenantry Riflemen	28th June, “
Deputy-Lieutenant for the City of Northumberland	23rd June, 1807
Commissioner for the Land Tax	“ “
Qualified for Magistrate, Co'y of Northumberland	8th Oct., “
One of the 24, Parish of Alnwick	2nd Feb., 1808
Commissioner of the Breamish Turnpike Road	31st Jan'y, 1809

Qualified as Commissioner for the Land Tax	23rd March, 1809
Chosen a subscribing member of the Society for Promoting Christian Knowledge	9th Nov., 1808
Elected an honorary member of the Literary and Philosophical Society of Newcastle-upon-Tyne	1st Nov., 1809
Appointed a Trustee by Act of Parliament for the Turnpike Road from Newcastle to North Shields	18th April, 1810
Sworn in a Trustee for the Great North Road from Newcastle to Oxford	26th Jan'y, 1811
A Trustee for the Turnpike Road from Alnmouth to Hexham	29th April, 1809
A Vice-President of the Diocesan Branch of the Society for Promoting Christian Knowledge	' 1815
One of the gentlemen nominated for Sheriff of Northumberland	"
A Vice-President of the Alnwick Dispensary	"
Chairman of the Committee of Alnwick Dispensary	"
One of the Northumberland Committee for the Waterloo Subscription	"
Occasional Chairman for the District Committee of the Society for Promoting Christian Knowledge	"
Chairman of the Quarter Sessions in Northumberland 19th, 20th and	21st Oct., 1820
Created a Baronet. (*Gazette*)	27th July, 1821
Foreman of the Grand Jury at the Assizes for the County of Northumberland	March 1822
Ditto ditto	" 1823
First on the list to be Sheriff of Northumberland	Sept., 1823
Presented Address to the Duke of Wellington, and dined with His Grace at Alnwick Castle	Oct., 1827
Vice-President to Mechanics' Institute, Alnwick	2nd Aug., 1830
" " to Nat. His. Soc'y of North'd.	
Vice-President to Alnwick Library	16th May, 1834
" " (one of them) to Northumberland Agricultural Society	28th Sept., 1836
Proposed as Chairman of the Guardians of the Poor, but declined on account of age	Nov., 1836

SCHEDULE.

How Acquired	Park Lots, to whom gr'nted	By Purchase.		To Whom Granted.												Total number of Acres.
		To D. W. Smith		Town Lots.			Heads of Families.				Children of Hon. D. W Smith.					
Township.	D. W. Smith.	Town Lots.	Farm Lots.	Hon. D. W. Smith.	Mrs. Anne Smith.	Widow A. Smith.	Lt.-Col. John Smith.	Mrs. Anne Smith.	Hon'ble D. W. Smith.	Mrs. Anne Smith.	Mary Elizabeth.	David William.	Sarah.	Anne.	John O'Reilley.	
Ameliasburgh								600							1200	1800
Ancaster											1184	1200	1200			3584
Charlotteville								200								200
Crowland							200									200
Dorchester									$120\frac{6}{20}$							$120\frac{6}{20}$
Dunwick									150							150
Harwich									$199\frac{12}{20}$							$199\frac{12}{20}$
Howard									600							600
Louth									50							50
Niagara				4					202							206
Oxford-on Thames									500							500
Pickering							4800		1800					1200		7800
Rainham								200	295							495
Raleigh									280							280
Southwold									441							441
Stamford										5	16					21
Wainfleet									255							255
Walpole										1195						1195
Woodhouse								200	290							490
Yarmouth									410							410
York	200	$6\frac{3}{20}$	400	1	1	1			$407\frac{2}{20}$							$1016\frac{5}{20}$
Total number of acres	200	$6\frac{3}{20}$	400	5	1	1	5000	1200	6000	1200	1200	1200	1200	1200	1200	$20013\frac{3}{20}$

PAPERS USED AT THE NOVEMBER, 1893, SESSION OF THE BOARD OF EXAMINERS.

PRELIMINARY.

SUBJECT NO. 3—ARITHMETIC.

Max. Marks 100, Min. Marks 40.

No. 1. Give an example of a proper and an improper fraction, and state by what other names they are called.

No. 2. Reduce the following to an improper fraction: $969\frac{19}{23}$.

No. 3. Express the following improper fractions as whole numbers, $\frac{768}{24}$, $\frac{10101}{101}$.

No. 4. Multiply $\frac{17}{19}$ by 9, 3, 23, 47.

No. 5. Reduce the following compound fraction to a simple one, $\frac{6}{7}$ of $\frac{8}{11}$ of $\frac{15}{19}$.

No. 6. Express the following numbers in words, 762.762, .2436.

No. 7. Find the product of 2.236 and 2.4495.

No. 8. Divide 4.096 by 10.24 by 102.4 by 25.6 by .32 by .064.

No. 9. Extract the square roots of 625, 631, 961, 970, and give the remainder in each case.

GROUP NO. 4—LOGARITHMS AND ALGEBRA.

Max. Marks 100, Min. Marks 30.

1. Give the definition of a logarithm of a number. How many systems of logarithms have been constructed, and tables calculated, and by whom invented? What numbers may be taken as the bases of systems?

2. How are large numbers, say of 10 figures each, multiplied together when one number is a whole number and the other a decimal? How divided? Give full procedure as to each necessary step.

3. What is the logarithm of .001? Give the reason. Add the following logarithms, 5.3468541, 3.2685427. Add 6.3874654 and 2.9245636. Multiply $\bar{3}.7856473$ by 6; 35.86 by 2.1046; 0.8372 by 0.00294. Find the 365 power of 1.0045. Find the fourth root of 0.0076542.

4. Give explanations of the following expressions: "Tables of logarithmic sines, tangents, etc."; "Tables of natural sines, tangents, etc.," and show by examples how each are used.

5. Give the rules for adding, multiplying, subtracting and dividing algebraic fractional expressions, with an example of each and the proof of the rules.

6. What are equations of the first degree? Give the rules for working them and explain the same. Give an example.

7. What are simultaneous equations of the first degree with two or more unknown quantities? Give the various rules for working such equations and examples of the same.

8. Two casks contain equal quantities of water, from the first 34 quarts are drawn and from the second 80. The quantity remaining in one cask is now double that in the other. How much did each cask contain?

9.
$$\begin{aligned} 7x - 2z + 3u &= 17. \\ 4y - 2z + v &= 11. \\ 5y - 3x - 2u &= 8. \\ 4y - 3u + 2v &= 9. \\ 3z + 8u &= 33. \end{aligned}$$

Find values of x, v, y, u and z.

Subject No. 5—Euclid.

Max. Marks 100, Min. Marks 40.

1. Give the definitions of the following: Superficies, term or boundary, similar segments of circles, a right line placed in a circle, theorem, deduction.

2. Write out the following propositions: To bisect a given finite, straight line. Prop. 10, Bk. I.

3. To describe a square on a given right line. Prop. 46, Bk I.

4. Parallelograms upon equal bases and between the same parallels are equal to each other. Prop. 36, Bk. I.

5. If a right line be divided into any two parts, the rectangles contained by the whole and each of the parts are together equal to the square of the whole line. Prop. 2, Bk. II.

6. To describe a square that shall be equal to a given rectilineal figure. Prop. 14, Bk. II.

7. The opposite angles of any quadrilateral figure inscribed in a circle are together equal to two right angles. Prop. 22, Bk. III.

8. In equal circles, equal arcs are subtended by equal right lines. Prop. 29, Bk. III.

9. To describe a circle about a given square. Prop. 9, Bk. IV.

10. To describe a circle about a given equiangular and equilateral pentagon. Prop. 14, Bk. IV.

Group No. 6—Plane Trigonometry and Rules for Spherical.

Max. Marks 100, Min. Marks 40.

1. Define the three modes of measuring angles, called the sexagesimal, the centesimal and the circular, and give examples of each.

2. Show that the unit of circular measure is equal to 57°.2958 nearly, and that an angle whose circular measure is 180° and an angle whose circular measure is $\frac{\pi}{2}$ equals 90° and 2π equals 360°. Express in circular measure 60°. Express in circular measure 22°, 30′, 0″.

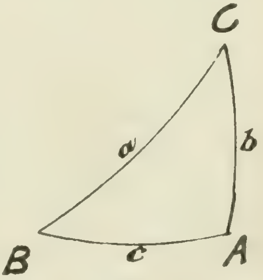
3. Give the rules for solving plane triangles. (*a*) Given two sides and an angle opposite one side. (*b*) Given two sides and the included angle. (*c*) Given three sides. Give proofs of rules.

4. Give rules for solving plane, right-angled triangles. (*a*) Given hypotenuse and angle at base. (*b*) Base and angle at the base. Give proofs of rules.

5. Given two sides of a plane triangle, viz. : 1686 and 960 and their included angle 128°, 4′, 0″—Required the other two angles.

6. Give Napier's rules for solving right-angled spherical triangles.

7. In this triangle :
Given a and c to find b.
" C " c " a.
" B " b " C. Assume $A = 90^\circ$.



8. Give the rules for solving any spherical triangle when (*a*) Given two sides and an angle opposite one side. (*b*) Given two sides and their included angle. (*c*) Given three sides, to find the angles.

9. (*a*) Of what arcs are the sides of spherical triangles constructed ? (*b*) How many right angles may there be in the sum of the three angles of any spherical triangle ?

SUBJECT No. 7—MENSURATION OF SUPERFICIES.

Max. Marks 50, Min. Marks 25.

1. The area of an equilateral triangle is 10 acres. Required, the length of a side in chains and links.

2. The base of a triangle is 56 chains, the height is 15 chains and one side is 25 chains. Required the other side.

3. Find the circumference of a circle equal in area to a square whose side is 300.

4. What is the area of a trapezoid whose parallel sides are 4 feet 6 inches, and 8 feet 3 inches, and the perpendicular height 5 feet 8 inches ?

5. What is the area of a field whose south side is 27 chains 40 links ; east side, 35 chains 75 links ; north side, 37 chains 55 links ; west side, 41 chains 5 links ; and the diagonal from south-west to north-east, 48 chains 35 links.

Subject No. 8—Linear Drawing.

Max. Marks 50, Min. Marks 25.

1. Draw five parallel lines one-half inch apart, the top line thin and dotted, the bottom line thick and dotted, the centre line thick, and the intermediate lines thin.

2. Draw three concentric circles with radii 1 inch, $1\frac{1}{8}$ inch, and $1\frac{1}{4}$ inch, respectively. Ink in the outer one with heavy dots, the middle one with chain dots, and the inner one with simple dots.

3. Draw three circles with radii of one inch, each circle touching the other two. Show the construction in pencil, and ink the circles as in question 2.

4. Draw a scale for a plan on which 80 feet is represented by one inch. Make it long enough, and so divided, that 495 feet may be taken off it directly. Give its representative fraction.

5. Draw a line four inches long and divide it by construction into seven equal parts.

6. Construct, as accurately as you can, a triangle, the sides being respectively, $2\frac{1}{4}$, $2\frac{1}{2}$, and $2\frac{3}{4}$ inches long. Ink the figure in the finest lines you can.

7. Construct angles of 15°, 30°, 45°, 60°, and 120° (without protractor). (Instruments to be used are, pencil, straight-edge, pen, dividers with pen and pencil points, and scale or rule divided into inches and eighths).

FINAL.

Subject No. 1—Geometry.

Max. Marks 100, Min. Marks 50.

1. If the square described on one of the sides of a triangle be equal to the squares described on the other two sides of it, the angle contained by these two sides is a right angle. Prop. 48, Bk. I.

2. If two circles touch each other, internally, the straight line which joins their centres being produced, shall pass through the point of contact. Prop. 11, Bk. III.

3. In a circle the angle in a semi-circle is a right angle ; but the angle in a segment greater than a semi-circle, is less than a right angle, and the angle in a segment less than a semi-circle, is greater than a right angle. Prop. 31, Bk. III.

4. To describe a circle about a given square. Prop. 9, Bk. IV.

5. In a right-angled triangle if a perpendicular be drawn from the right angle to the base, the triangles on each side of it are similar to the whole triangle and to one another. Prop. 8, Bk. VI.

6. Similar triangles are to one another in the duplicate ratio of their homologous sides. Prop. 19, Bk. VI.

7. If a straight line touch a circle and from the point of contact a straight line be drawn cutting the circle, the angle which this line makes with the line touching the circle shall be equal to the angles which are in the alternate segments of the circle. Prop. 32, Bk. III.

8. The opposite angles of any quadrilateral figure inscribed in a circle are together equal to two right angles. Prop. 22, Bk. III.

9. To divide a given straight line into two parts so that the rectangle contained by the whole and one of the parts may be equal to the square on the other part. Prop. 11, Bk. II.

10. If a straight line be divided into two equal parts and also into two unequal parts, the rectangle contained by the unequal parts, together with the square on the line between the points of section, is equal to the square on half the line. Prop. 5, Bk. II.

SUBJECT NO. 2—ALGEBRA.

Max. Marks 100, Min. Marks 40.

1. Define, (*a*) Greatest Common Measure ; (*b*) Least Common Multiple. Find the G. C. M. of $6x^4 + x^3 - x$ and $4x^3 - 6x^2 - 4x + 3$. Find the L. C. M. of $x^2 - (a + b)x + ab$, $x^2 - (b + c)x + bc$ and $x^2 - (c + a)x + ca$.

2. Define the following : (*a*) Equation ; (*b*) Identity. Prove, (*a*) That if every term on each side of an equation be multiplied or divided by the same quantity the results are equal ; (*b*) That any quantity may be transposed from one side of an equation to the other by changing its sign. Give the rule for the solution of any equation of the 1° with one unknown quantity. Solve the following : $\frac{1}{6}(8 - x) + x - 1\frac{2}{3} = \frac{x + 6}{2} - \frac{x}{3}$

3. A crew which can pull at the rate of 9 miles an hour finds that it takes twice as long to come up a river as to go down. At what rate does the river flow ?

The length of a field is twice its breadth, another field which is 50 yards longer and 10 yards broader contains 6,800 square yards more than the first. Find size of each.

4. Define, (*a*) Involution ; (*b*) Evolution ; (*c*) Find $(1 + 2x + 3x^2)^2$; (*d*) Find $(1 + 2x + 3x^2)^3$; (*e*) Extract the square root of $4x^4 - 4x^3 + 5x^2 - 2x + 1$.

5. What is the meaning of $a^{\frac{1}{2}}, a^{\frac{1}{3}}, a^{\frac{m}{n}}$. Simplify $(x^{\frac{2}{3}} \times x^{\frac{4}{7}})^{\frac{11}{13}}$. Find the product of $\left(\frac{ay}{x}\right)^{\frac{1}{2}}, \left(\frac{bx}{y^2}\right)^{\frac{1}{3}}$ and $\left(\frac{y^2}{a^2b^2}\right)^{\frac{1}{4}}$.

6. What is the rule for solving a quadratic equation ? What are the roots of the equation $ax^2 + bx + c = 0$. When are they real and when impossible ? Solve the following : (*a*) $3x^2 - 7x = 20$; (*b*) $(2x + 1)(x + 2) = 3x^2 - 4$. The length of a rectangular field exceeds

the breadth by one yard and the area is three acres. Find the lengths of the sides in yards.

7. When are quantities said to be in (*a*) arithmetical progression; (*b*) geometrical progression? What is the rule for finding the sum of any number of terms in an arithmetical progression when "*a*" equals first term, "*l*" equals last term, "*s*" equals sum, and "*n*" equals number of terms. Sum to 21 terms $\frac{5}{7}$, $\frac{2}{3}$, $\frac{13}{21}$. How many terms of $1 + 3 + 5 + 7 +$ &c. amount to 1234321? What is the rule for finding the sum of any number of terms in a geometrical progression when "*a*" equals first term, "*r*" equals common ratio, "*n*" equals number of terms, "*s*" equals the sum of the terms, and "*I*" equals last term?

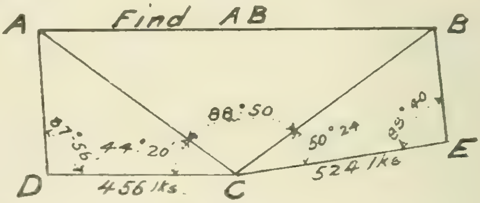
Group No. 3—Plane and Spherical Trigonometry.

Max. Marks 100, Mim. Marks 50.

1. Give the rules and prove the same, for solving plane triangles, when (*a*) Two sides and an angle opposite one side are given; (*b*) Two sides and the included angle given, to find the other parts; and (*c*) When the three sides are given to find the angles.

2. Given data shown on figure to find *AB*.

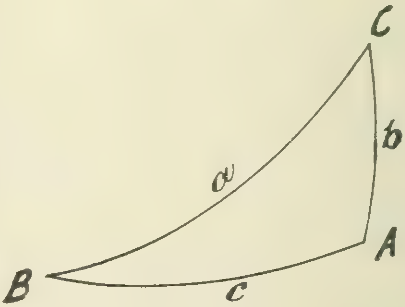
3. Explain the difference between a table of logarithmic sines, tangents, &c., and a table of natural sines, tangents, &c., and how each is used.

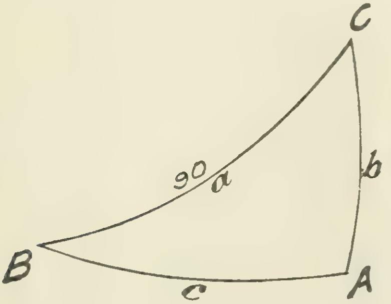


4. By the centesimal mode of measuring angles, find the number of grades, minutes and seconds in the following angle: 300° 15′ 58″.

5. Give Napier's rules of circular parts for solving spherical triangles, and prove the same.

6. In this triangle:
Given *B* and *C* find *c*.
" *b* " *c* " *a*.
" *a* " *C* " *c*.
Show how each is found.





7. In this quadrantal triangle, given *CB* equal 90°, *C* equal 42°, 12′, *A* equal 115°, 20′. Find *B*, *c*, and *b*.

8. In a spherical triangle, given three sides, a equal $40^\circ\ 18'\ 29''$, b equal $67^\circ\ 14'\ 28''$, and c equal $89^\circ\ 47'\ 06''$. Required the angle A.

9. In a spherical triangle ABC there are given: A equal $34^\circ\ 15'\ 03''$, B equal $42^\circ\ 15'\ 13''$, and side c equal $76^\circ\ 35'\ 36''$. Required the angle C.

GROUP NO. 14—GEOLOGY AND MINERALOGY.

Max. Marks 75, Min. Marks 25.

1. Give the meaning of the term "geology," and the theory upon which it is based as a science.

2. How are rocks classified as to their origin? Give the names of three or more groups and the distinctive features of each.

3. Define the term "fossil," and state the theory as to their formation. In what kind of rocks are they found? State the name of the lowest formation in which fossils are found, and the kind.

4. Explain the meaning of the following terms: "stratified," "dip," "strike," "anticlinal," "synclinal," "conformable," "unconformable," and "fault."

5. State the theory of the "glacial deposits."

6. State the geological formations of Western Canada, say of Ontario, particularly.

7. State the theory of the formation of coal beds.

8. State the theory of the origin of petroleum as found in Canada.

9. What is lime, and in how many different forms does it appear as a rock? Are fossils found in all kinds of limestone? State the different purposes for which lime is used, and how prepared for use.

10. State the difference between "Azoic" and "Paleozoic" rocks.

11. What is the meaning of the term "mineralogy"?

12. How are minerals distinguished from one another? State the different characters.

13. Under what condition does color become a useful character in the discrimination of minerals?

14. Why is streak, in general, a more important character than color?

15. State the difference between metallic and sub-metallic lustre, with examples.

16. Name the different kinds of structure presented by mineral bodies.

17. State "Chapman's convenient scale of hardness."

18. What is the meaning of the expression "specific gravity," and how is it found—of a mineral body? If a piece of spar weighs 66 grs. in air and 46 grs. in water (distilled), what is its specific gravity?

19. Explain the use of the blow-pipe and the structure of the parts of the flame.

20 Give the meanings of the terms "electro-positive," and "electro-negative," and state how developed.

21. Explain the following terms, illustrating each by one or two examples: "Native substances," "oxide," "sulphide," "silicate," "carbonate."

GROUP No. 4—MENSURATION OF SUPERFICIES AND LAYING OUT AND DIVIDING LAND.

Max. Marks 150, Min. Marks 75.

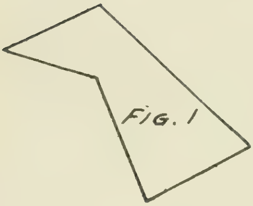


FIG. 1

1. Give the method and formula required for finding area of figures given by use of chain alone for measurement.

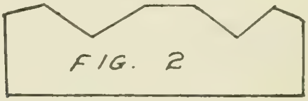


FIG. 2

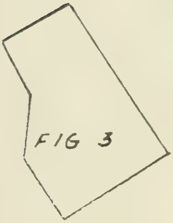


FIG 3

2. Explain the method of finding the area of the figure given by latitude and departure.

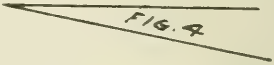


FIG. 4

3. Find the method and formula for parting off a given area from the above figure. (1) By a line perpendicular to one side. (2) By a line running in any direction.

4. The bearings and distances of the sides of the above figure being given, give the method of dividing it into two parts, having a given ratio by a line running parallel to one of the sides.

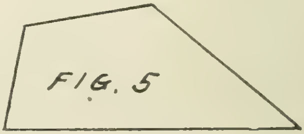


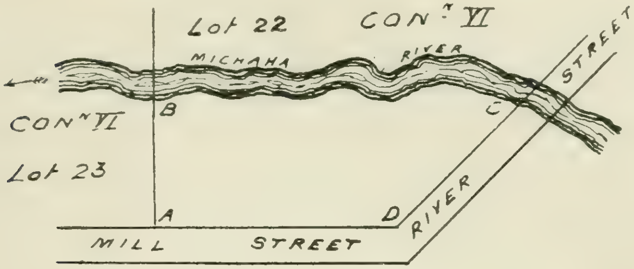
FIG. 5

SUBJECT No. 5—DESCRIPTIONS BY METES AND BOUNDS.

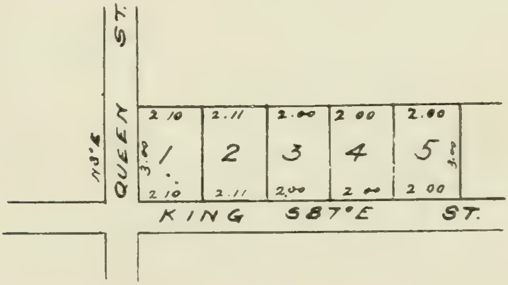
Max. Marks 100, Min. Marks 75.

1. Give some instances in which the term "more or less" may be used in a description.

2. Give definition of the terms "bank" and "shore."



3. Write description of the property *A*, *B*, *C*, *D*, in the diagram, giving imaginary bearings and distances.



4. Write out description of the east half of Lot No. 3, in above figure, supposing there to be no registered plan of the subdivision.

SUBJECT NO. 7—THE LAYING OUT OF CURVES.

Max. Marks, 50, Min. Marks, 20.

1. Given a curve of radius, 955,366 feet; intersection angle, 62 24; required the tangent.

2. A curve of 985,451 feet radius is "What degree of curve"?

3. Show how any offset—from the tangent—to any curve may be approximately calculated in terms of the degree of curve and the number of 100 feet chords.

4. The radius of a curve is 890 feet; it is required to find the ordinate to a chord of 100 feet at a point 46 feet from one end.

5. It is found, on stretching a chord of 100 feet, that the ordinate at the centre is 4,374 feet. Required the radius of the curve.

6. It is frequently necessary to lay out a curve by the chain only. Give the detail work necessary, and describe fully how would lay out a 12 curve 750 feet long, using a chain and box-sextant or optical square.

Subject No. 8—Practical Astronomy.

Max. Marks, 150; Min. Marks.

1. Define fully the following terms. Right ascension, azimuth, declination, zenith, terrestrial latitude and longitude ?

2. Explain fully what is meant by standard time ?

3. Define refraction, dip, parallax.

4. Explain fully and clearly the precaution necessary to determine by direct observation of (*a*) the sun, (*b*) a star, for azimuth and latitude.

5. March 11th, 1891. At a point in the County of Hastings, Ont., obs., mer., alt., suns lower limit, 41° 37′. Find latitude.

6. At a point on Ottawa river on April 3rd, 1874, the obs. transit of Procyon was found to be 47° 31′ 40″. Find latitude.

7. On January 25th, 1873, at a point on Ottawa river in latitude 46° 35′ 33″ the following observations were taken of the sun's lower limb west of the Meridian. Find error of watch.

TIMES.	ALTITUDES.
2h. 5m. 41s	19° 15′ 20″
2h. 6m. 10½s.	19° 13′ 0″
2h. 6m. 34s.	19° 11′ 0″
2h. 7m. 0s.	19° 8′ 20″
2h. 7m. 29½s.	19° 6′ 0″
2h. 7m. 54s.	19° 3′ 40″
2h. 8m. 17½s.	19° 1′ 20″
2h. 8m. 58s.	18° 58′ 50″

8. The latitude of Violet, Ont., is 44° 10′ north. Required number of miles in degree of longitude there, with diagram.

9. At a point in the district of Algoma on October 18th, 1887, at 9 a.m., in latitude 46° 31′ 16″ north, the obs., alt. sun's lower limb was 24° 47′. Find azimuth of sun.

SUBJECT NO. 9—SURVEY ACT.

Max. Marks 150, Min. Mark.

1. Give a form of oath to be administered to a chain-bearer.

2. Give proceedings to be followed if a person refuses to attend to be examined, as to a boundary, by a surveyor.

3. In what manner, on the ground, should you proceed to establish a partly obliterated concession line which was intended, in the original survey, to be straight?

4. In a township where no proof-lines have been run, which is the governing line?

5. Which is the governing line in townships divided into sections of 1,000 acres, or thereabouts?

6. How would you proceed to establish a point where the original post cannot be found. (*a*) In a single front concession? (*b*) In a double front concession?

7. Give method of running side-lines of lots. (*a*) In single front concessions. (*b*) In double front concessions.

GROUP NO. 10—MINING AND OTHER ACTS.

1. What are the requirements of a plan or map of a sub-division of a parcel of land to make it comply with the Registry Act? Answer fully, giving form of Surveyor's certificate.

2. (*a*) Define "Mining Location." (*b*) In the unsurveyed territory, within the District of Algoma, what shall be the shape, size, and bearings of outlines of mining locations. (*c*) Who shall survey them, and how?

3 Give briefly the chief differences between the "Municipal Drainage Act" and the "Ditches and Watercourses Act." (*b*) Why, in your opinion, are the two Acts necessary?

4. An engineer receives a requisition for a drain under the Ditches and Watercourses Act, on the 6th Nov., 1893. State his duties until the "Award" is filed with the clerk of the township, giving dates to which he is limited for the performance of the various parts ot his work.

5. Give the course to be pursued when a drain, constructed under the Ditches and Watercourses Act, requires to be cleaned out.

6. In case of the non-completion of any part of a drain award under the Ditches and Watercourses Act, state the course to be pursued to have it completed, setting forth clearly the engineer's duties.

7. How would you proceed to obtain the drainage of a tract of land under the Municipal Drainage Act. State the duties of the municipal council in the matter.

8. In case a drain commencing in one township is required to be continued into another township for an outlet, what course is required to be pursued?

9. How are drains which are in more than one township, kept in repair?

10. What is meant by "A work of preservation, maintenance, and keeping in repair" of a drain as applied to this Act?

SUBJECT NO. 11—LEVELLING.

Max. Marks 50, Min. Marks 35.

1. (*a*) What is a level surface? (*b*) Give the difference between true and apparent levels.

2. Show that the difference between true and apparent levels vary as the square of the distance.

3. What is a "bench mark" and a "turning-point"? What is a "datum line"?

4. Show a form of book for entering levels taken in a field; enter thereon an imaginary course of levels, of at least fifteen stations, including benches, fore-sights, back-sights, intermediates, turning-points, and reduction of levels to a datum line.

5. Give a detailed statement of the procedure in taking levels in the field.

SUBJECT NO. 12—PRINCIPLES OF EVIDENCE AND DRAWING UP OF AFFIDAVITS.

Max. Marks 80, Min. Marks 30.

1. For what purposes are Ontario Land Surveyors empowered to take affidavits?

2. Give a case in which more than one witness is required to an affidavit taken by an Ontario Land Surveyor.

3. What should be done with an affidavit taken by an O. L. S. for the purpose of keeping it on record?

4. How would you first proceed to obtain evidence for a survey under instructions from the Commissioner of Crown Lands ?

5. In the case of a person refusing to give evidence, or produce documents, as to a boundary, how would you proceed to obtain the same ?

6. Give a form for drawing up an affidavit to establish the original position of an original post or monument.

NEW BY-LAWS.

By-Law No. 34. " The following surveyors having duly registered and having proved to the satisfaction of the Council that they had been respectively in actual practice as duly authorized and qualified Land Surveyors for Ontario for a period of not less than 35 years prior to July 1st, 1892, are hereby placed on the list of registered Surveyors for Ontario, and are exempt from the payment of further dues under the authority of sub-section 4, of section 10, Ontario Statutes, 1892. Chapter 34, viz., Henry Strange, Milton C. Schofield, William Robinson, Joseph Kirk, Charles Fraser, Joseph M. O· Cromwell, H. O. Wood, F. H. Lynch-Staunton, and E. C. Caddy." Passed by Council of Management 11th Nov., 1893. Ratified by Association at annual meeting, 1st March, 1894.

By-Law No. 35. "The annual fees to this Association, paid by candidates who are admitted at the November examination in each year shall cover all annual dues for the remainder of such current Association year and for the Association year following the same." Passed by Council of Management, 11th November, 1893. Ratified by Association at annual meeting, 1st March, 1894.

By-Law No. 36. " The following Surveyors, having duly registered and having proved to the satisfaction of the Council that they had been respectively in actual practice as duly authorized and qualied Land Surveyors for Ontario for a period of not less than 35 years prior to July 1st, 1892, are hereby placed on the list of registered Surveyors for Ontario, and are exempt from the payment of further dues under the authority of sub-section 4 of section 10, Chapter 34, Ontario Statutes 1892, viz., Thomas Coltrin Keefer, Nathaniel Edward Low, Thomas Cheesman, James McCallum and Thomas W. Walsh." Passed by Council of Management, 4th April, 1894.

By-Law No. 37. " Whereas it has been proven to the satisfaction of the Council that Royal Wilkinson Hermon was granted a certificate as Provincial Land Surveyor, dated 13th July, 1857, and had therefore been a duly qualified Land Surveyor for 35 years, less 12 days, prior to the first day of July, 1892. It is therefore enacted that the said Royal Wilkinson Hermon is hereby granted exemption from dues under the authority of sub-section 4 of section 10, Chapter 34, Ontario Statutes 1892." Passed by Council of Management, 4th April, 1894.

By-Law No. 38. " Whereas it has been recommended by the Board of Examiners that the minimum marks in the subject of levelling be reduced from 40 to 35, it is therefore hereby enacted that the minimum number of marks required to be taken by each successful candidate in the subject of levelling shall be 35 instead of 40 as set forth in By-law number 29." Passed by Council of Management 4th April, 1894.

By-Law No. 39. "Whereas any registered surveyor desiring to give up practice can have his name removed from the registered list of practitioners at any time, upon giving written notice of such desire, and whereas it is desirable that such surveyors may contribute papers and secure the reports of the transactions of this Association and exchanges, therefore this Council hereby enacts that such surveyors shall have the aforesaid privileges upon the payment of an annual fee of two dollars, and their names shall be printed in the list of members in the annual report of the Association and properly marked." Passed by Council of Management 7th April, 1894.

LIST OF MEMBERS.

Names marked * have been granted exemption under ratified By-laws; and those marked †, under By-laws passed by Council since the annual meeting of the Association.

Abrey, George Brockitt	Toronto Junction.
Aylsworth, Charles Fraser, Sr.	Madoc.
Aylsworth, Charles Fraser, Jr	Madoc.
Aylsworth, John Sidney	Selby, P. O. Box 23.
Aylsworth, William Robert	Belleville, P.O. Box 2.
Baird, Alexander	Leamington.
Barrow, Ernest George	Hamilton, City Hall.
Bazett, Edward	Burk's Falls.
Beatty, David	Parry Sound.
Beatty, Herbert John	Pembroke.
Beatty, Walter	Delta.
Bell, Andrew	Almonte.
Bell,James Anthony	St. Thomas.
Bigger, Charles Albert	Ottawa, 68 Daly ave.
Bolger, Francis	Penetanguishene.
Bolger, Thomas Oliver	Kingston, City Engineer's Office.
Bolton, Jesse Nunn	Toronto, 264 Major st.
Bolton, Lewis	Listowel.
Booth. Charles Edward Stuart	Kingston, 196 Colborne st.
Bowman, Clemens Dersteine	West Montrose.
Bowman, Herbert Joseph	Berlin.
Bray, Edgar	Oakville.
Bray, Harry Freeman	Oakville.
Bray Samuel	Ottawa, Dept of Ind'n Affairs.
Brown, David Rose	Cornwall.
Brown, John Smith	Kemptville.
Browne, Harry John	Toronto, 17 Toronto st.
Browne, William Albert	Toronto, 17 Toronto st.
Burke, William Robert	Ingersoll.
Butler, Matthew Joseph	Napanee, P.O. Box 359.
Caddy, Cyprian Francis	Campbellford.
*Caddy, Edward C	Cobourg.
Caddy, John St. Vincent	Ottawa, 559 King st.
Cameron, Alfred John	Peterborough.
Campbell, Archibald William	St. Thomas.
Carre, Henry	Belleville, P.O. Box 203.
Carroll, Cyrus	Hamilton, 6½ James st. s.
Casgrain, Joseph Philippe Bâby	Morrisburg.

Cavana, Allan George	Orillia.
†Cheesman, Thomas	Mitchell.
Chipman, Willis	Toronto, 103 Bay st.
Coad, Richard	Glencoe.
Cozens, Joseph	Sault Ste. Marie.
Creswicke, Henry	Barrie.
*Cromwell, Joseph M. O	Perth.
Davidson, Alexander	Arkona.
Davidson, Walter Stanley	Arkona.
Davis, Allan Ross	Napanee.
Davis, John	Alton.
Davis, William Mahlon	Woodstock.
Deacon, Thomas Russ	Rat Portage.
Deane, Michael	Lindsay.
Deans, William James	Oshawa.
DeGurse, Joseph	Windsor, P.O. Box 167.
DeMorest, Richard Watson	Sudbury.
Dickson, James	Fenelon Falls.
Dobbie, Thomas William	Tilsonburg.
Doupe, Joseph	Winnipeg, Man., 411 Main st.
Ellis, Henry Disney	Toronto, City Hall.
Esten, Henry Lionel	Toronto, 157 Bay st.
Evans, John Dunlop	Trenton.
Fair, John	Brantford.
Fairbairn, Richard Purdum	Toronto, 127 Major st.
Fairchild, Charles Court	Brantford.
Farncomb, Frederick William	London, 213 Dundas st.
Fawcett, Thomas	Ottawa, Dept. of Interior.
Fitton, Charles Edward	Orillia, Drawer 31.
Fitzgerald, James William	Peterborough, Box 333.
Flater, Frederick William	Chatham.
Foster, Frederick Lucas	Toronto, 157 Bay st.
Francis, John James	Sarnia, Box 304.
*Fraser, Charles	Wallaceburg.
Galbraith William	Bracebridge.
Gamble, Killaly	Toronto, 193 Bloor st. e.
Gardiner, Edward	St. Catharines.
Gaviller, Maurice	Collingwood, Box 773.
Gibbons, James	Renfrew.
Gibson, George	St. Catharines.
Gibson, Harold Holmes	Willowdale.
Gibson, Peter Silas	Willowdale.
Graydon, Aquila Ormsby	London.
Griffin, Albert Dyke	Woodstock, Box 612.
Hanning, Clement George	Preston.

Hart, Milner	Toronto, 103 Bay st.
Harvey, Thomas Alexander	London, 1 Oxford st
Henderson, Eder Eli	Henderson P.O., Maine.
Henry Frederick	London, Albion Building.
†Hermon, Royal Wilkinson	Rednersville.
Hewson, Thomas Ringwood	Peterborough.
Hobson, Joseph	Hamilton, G. T. Ry. Office.
Hopkins, Marshall Willard	Hamilton, 28 James st. s.
Howitt, Alfred	Gourock,
Hutcheon, James	Guelph.
Innes, William Livingstone	Peterborough.
James, Darrell Denman	Toronto, 19 Richmond st. e.
James, Silas	Toronto, 19 Richmond st. e.
Johnson, Robert Thornton	Toronto, 131 Wellington st. w.
Jones, Charles Albert	London, 213 Dundas st.
Jones, John Henry	Sarnia.
Jones, Thomas Harry	Brantford.
†Keefer, Thomas Coltrin	Ottawa.
Kennedy, James Henry	St. Thomas, P.O. Box 434.
Kippax, Hargreaves	Huron, South Dakota.
*Kirk, Joseph	Stratford.
Kirkpatrick, George Brownly	Toronto, Dept. of Crown Lands.
Klotz, Otto Julius	Ottawa, Dept. of Interior.
Laird, James Steward	Essex Centre.
Laird, Robert	Toronto, City Hall.
Lendrum, Robert Watt	Vankleek Hill.
Lewis, John Bower	Ottawa, Brunswick House.
Lougheed, Aaron	Port Arthur.
†Low, Nathaniel E.	Wiarton.
Lumsden, Hugh David	Toronto, 63 Homewood ave.
*Lynch-Staunton, Francis H	Hamilton.
Macdougall, Allan Hay	Port Arthur.
MacKenzie, William Lyon	Mattawa.
MacNabb, John Chisholm	Chatham.
McAree, John	Toronto, 86 King st. e.
†McCallum, James	Rat Portage.
McCulloch, Andrew Lake	Galt.
McDonell, Augustine	Chatham, 4 & 5 Ebert's Block.
McDowall, Robert	Owen Sound.
McEvoy, Henry Robinson	St. Marys.
McFadden, Moses	Neepawa, Man.
McFarlen, George Walter	Toronto, Court House.
McGeorge, William Graham	Chatham.
McGrandle, Hugh	Huntsville.
McKay, Owen	Windsor.

McKenna, John Joseph	Dublin.
McLatchie, John	Ottawa, 28 Stanley ave.
McLean, James Keachie	Elora.
McLennan, Murdoch John	Williamstown.
McLennan, Roderick	Toronto, 115 Avenue rd.
McMullen, William Ernest	Toronto, 7 Murray st.
McNab, John Duncan	Owen Sound.
McPhillips, George	Windsor, P.O. Box 556.
Malcolm, Sherman	Blenheim.
Manigault, William Mazyck	Strathroy, P.O. Box 300.
Marshall, James	Holyrood.
Miles, Charles Falconer	Toronto, 320 Spadina ave.
Moore, John Mackenzie	London cor. Rich'd & Carling sts.
Moore, John Harrison	Smith's Falls.
Moore, Thomas Alexander	London South.
Morris, James Lewis	Pembroke.
Mountain, George Alphonse	Ottawa.
Murdoch, William	Port Arthur.
Murphy, Charles Joseph	Toronto, 157 Bay st.
Newman, William	Windsor, 57 Sandwich st.
Niven, Alexander	Haliburton.
Ogilvie, John Henry	W. Sup'r, Wis , 1810½ Tower ave.
Ogilvie, William	Ottawa, Dept. of Interior.
O'Hara, Walter Francis	Chatham.
Paterson, James Allison	Toronto, 23 Adelaide st. e.
Patten, Thaddeus James	Little Current.
Pinhey, Charles Herbert	Coteau Landing, Que.
Pope, Robert T.	Baysville.
Proudfoot, Hume Blake	Toronto, 78 Con. Life Bdg.
Purvis, Frank	Eganville.
Reid, James Hales	Bowmanville.
Reilly, William Robinson	Regina, Assa.
Ritchie, Nelson Thomas	Kincardine.
Roberts, Vaughan Maurice	New York, 137 Broadway.
Robertson, James	Glencoe.
*Robinson, William	London, 322 York st.
Roger, John	Mitchell.
Rorke, Louis Valentine	Sudbury.
Ross, George	Welland.
Rubidge, Tom S.	Cornwall.
Russell, Alexander Lord	Port Arthur.
Sanderson, Daniel Leavens	Wilton.
Sankey, Villiers	Toronto, City Hall.
Saunders, Bryce Johnston	Brockville, P.O. Box 114
Scane, Thomas	Ridgetown.

*Schofield, Milton C..............Guelph.
Seager, Edmund................Rat Portage.
Selby, Henry Walter............Toronto, 408 Huron st.
Sewell, Henry DeQuincey........Port Arthur.
Silvester, George Ernest ....Ringwood.
Sing, Josiah Gershom............Meaford.
Smith, George..................Woodville.
Smith, Henry ....Toronto, Crown Lands Dept.
Speight, Thomas Bailey ....Toronto, Yonge St. Arcade.
Steele, Charles Edward..........Goderich.
Stewart, Elihu....... ....Collingwood.
Stewart, John ....Ottawa.
Stewart, Walter Edgar..........Aylmer.
*Strange, Henry ....Rockwood.

Tiernan, Joseph Martin..........Tilbury Centre.
Traynor, Isaac..................Dundalk.
Turnbull, Thomas...............Winnipeg, Man., C.P.R. Office.
Tyrrell, James Williams.... ....Hamilton, 42 St. James st. n.

Unwin, Charles ....Toronto, 157 Bay st.
Ure, Frederick John ....Woodstock.

VanBuskirk, William Fraser ....Stratford.
VanNostrand, Arthur J..........Toronto, Yonge St Arcade.

Wadsworth, Vernon Bayley.......Toronto, 103 Bay st.
Walker, Alfred Paverley ....Toronto, C.P.Ry. Eng. Office.
Wallace, Charles Hugh...........Hamilton.
†Walsh, Thomas W..............Simcoe.
Warren, James ....Walkerton, Box 190.
Watson, John McCormack ......Orillia, P.O. Box 224.
Weatherald, Thomas ....Goderich, P.O. Box 273.
Wheelock, Charles Richard......Orangeville.
Whitson, James Francis ....Toronto, Crown Lands Dept.
Wicksteed, Henry King ....Cobourg.
Wiggins, Thomas Henry ....Napanee.
Wilde, John Absalom............Sault Ste. Marie
Wilkie, Edward Thomson........Carleton Place.
Wilkins, Frederick William......Peterborough, 372½ Water st.
Williams, David ....Kingston, 220 King st.
Winter, Henry..................Thornyhurst.
*Wood, Henry O................Billings' Bridge.

Yarnold, William Edward........Port Perry, P.O. Box 44.

REGISTERED AND WITHDRAWN,

Apsey, John Fletcher............Baltimore, Md., 2125 N. Chas. st.

Bowman, Arthur Meyer ....Berlin.

Bowman, Leander Meyer.........Toronto, Medical Health Office.
Bowman, Franklin Meyer........Berlin.
Burnet, Hugh..................Victoria, B.C.

Cambie, Henry John............Vancouver, B.C.
Coleman, Richard Herbert......Toronto, 204 King st. e.

Drewry, William Stewart........Ottawa, Dept of Interior.
Ducker, William A..............Winnipeg, M., 314 McWilliam st.

Edwards, George..............Thurso, Que

Fowlie, Albert..................Orillia.

Green, Thomas Daniel..........Ottawa, Dept. of Indian Affairs.
Galbraith, John................Toronto, Sch. of Prac. Science.

Haskins, William..............Hamilton, 45 Wellington st. s.
Harris, John Walter............Winnipeg, Assm't. Com. Dept.
Hermon, Ernest Bolton........Vancouver, B.C.

Irwin, James M.................Peterborough.

Jephson, Richard Jermy........Calgary, Alta.

Kains, Tom....................Victoria, B.C.

Livingstone, Thomas Chisholm..Winnipeg, Man.

MacLeod, Henry Augustus F....Ottawa, 340 Cooper st.
MacPherson, Duncan............Montreal, Que.
Magrath, Charles Alexander......Lethbridge, Alta.

Pearce, William................Calgary, Alta.
Pedder, James Robert..........Doon.
Ponton, Archibald William......Regina, Assa.

Reiffenstein, James H............Peterborough.
Rogers, Richard Birdsall........Ottawa, Dept. of Interior.
Ross, Joseph Edmund............New Westminster, B.C.

Strathern, John..............Vancouver, B.C.
Sherman, Ruyter S..............Vancouver, B.C.
Simpson, George Albert..........Winnipeg, Man., N. P. & M. R'y.
Spry, William..................Toronto.
Stewart, Louis Beaufort..........Toronto, Sch. of Prac. Science.

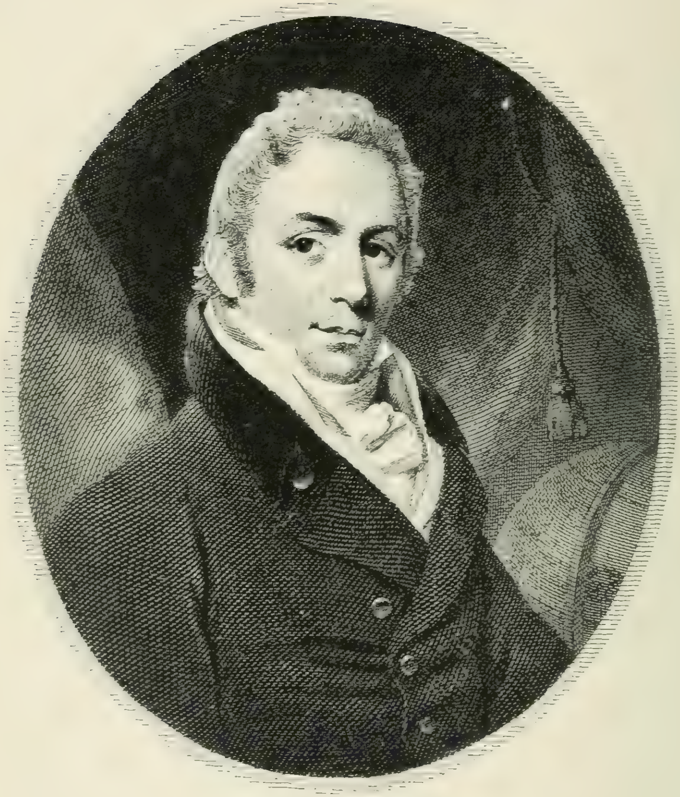
Thomson, Augustus Clifford.......Kansas City., Mo.
Tracey, Thomas H.............Vancouver, B.C.

Vicars, John Richard Odlum	Kamloops, B.C

Weekes, Abel Seneca	Wetaskiwin, Alta.
Wheeler, Arthur Oliver	New Westminster, B.C.
Willson, Alfred	Toronto, 204 King st e.

SUMMARY.

Active members subject to dues	198
Active members exempted from dues	15
Withdrawn from practice	40
Dead	1
Total number enrolled since incorporation	254



JOSEPH BOUCHETTE,

Surveyor-General of Lower Canada and Lieut.-Col. C. M.

PROCEEDINGS
OF THE
ASSOCIATION
OF
ONTARIO LAND SURVEYORS

At its Third Annual Meeting, since Incorporation,

HELD AT

TORONTO, FEBRUARY 26TH, 27TH AND 28TH,

1895

Being the Tenth Annual Meeting of the Association of Provincial Land Surveyors of Ontario

The Fourth Annual Meeting (Eleventh Annual Meeting of the Association of Provincial Land Surveyors of Ontario) will be held in Toronto, commencing on Tuesday, 25th of February, 1896.

PRINTED FOR THE ASSOCIATION
BY
C. BLACKETT ROBINSON, 5 JORDAN STREET,
TORONTO.

PATRONIZE OUR ADVERTISERS.

NOTICES.

The attention of the members is called to the list of Standing and Special Committees as given on page 6. Each member should assist the Committees as much as possible.

Members and others can be supplied with copies of the Proceedings for 1886, 1887, 1888, 1889, 1891, 1892, 1893, or 1894 by remitting fifty cents to the Secretary.

Copies of the Ontario Land Surveyors' Act and By-Laws of the Association will be sent upon receipt of three-cent stamp.

The thanks of the Association are due to the Faculty and Alumni Society of the School of Practical Science for the very interesting and instructive entertainment tendered to the members in attendance at the annual meeting of 1895.

Published annually by the Association of Ontario Land Surveyors.

Edition 1,150 copies ; price 50 cents.

PATRONIZE OUR ADVERTISERS.

PREFACE.

To the Members of the Association of Ontario Land Surveyors:

The Proceedings of the Association at its Third Annual Meeting since incorporation are herewith presented.

Appended will be found By-Laws passed by the Council since the date of the meeting.

It will be seen that the Committees have been active and earnest in the promotion of the interests of their several departments, and it is hoped that they will be even more energetic this year.

Each member of the Association, whether a member of a committee or in the ranks, is requested to lend his aid for the advancement of the profession.

Respectfully submitted on behalf of the Council,

A. J. VanNOSTRAND,
Secretary.

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ASSOCIATION OF

ONTARIO LAND SURVEYORS

(Incorporated 1892).

ORGANIZED 23RD FEBRUARY, 1886.

Officers for 1895-96.

PRESIDENT.

M. Gaviller, O L.S., Collingwood.

VICE-PRESIDENT.

Willis Chipman, O L.S., Toronto.

CHAIRMAN OF COUNCIL.

Villiers Sankey, O.L.S., Toronto.

SECRETARY-TREASURER.

A. J. VanNostrand, O.L.S , Toronto.

COUNCILLORS

Hon. A. S. Hardy, Commissioner of Crown Lands.	
P. S. Gibson, Willowdale	For 3 years.
F. L. Foster, Toronto	
Villiers Sankey, Toronto	For 2 years.
H. J. Bowman, Berlin	
G. B. Kirkpatrick, Toronto	For 1 year
Alex. Niven, Haliburton.	

AUDITORS.

H. B. Proudfoot, Toronto.
A. P. Walker, Toronto.

BANKERS.

Imperial Bank of Canada (Yonge Street Branch, Toronto).

BOARD OF EXAMINERS.

Villiers Sankey, Toronto (Chairman).	
M. J. Butler, Napanee G. B. Kirkpatrick, Toronto	Appointed by Lieut.-Gov. in Council.
P. S. Gibson, Willowdale A. Niven, Haliburton	For 3 years, appointed by Council.
M. Gaviller, Collingwood R. Coad, Glencoe	For 2 years, appointed by Council.

STANDING COMMITTEES FOR 1895-6.

Land Surveying —T. B. Speight (Chairman), James Dickson, F. L. Foster, H. H. Gibson, J. L. Morris, A. Niven, C. Unwin J. F. Whitson

Drainage.—Geo. Ross (Chairman), R. Coad, W. M. Davis, Owen McKay, J. M. Tiernan, T. H. Wiggins.

Engineering.—H. J. Bowman (Chairman), G. B. Abrey, M. J. Butler, J. DeGursé, Jas. Hutcheon, T. Harry Jones, Jas. Robertson, A. P. Walker.

Entertainment.—H. D. Ellis (Chairman), F. L. Foster, W. E. McMullen, C. J. Murphy, T. B. Speight, A. P. Walker.

Publication.—K Gamble (Chairman), H. J Browne, Willis Chipman, H. L. Esten, F. L. Foster, J. McAree, C. J. Murphy H W. Selby.

Topographical Surveying.—Willis Chipman (Chairman), M. J. Butler, T. Fawcett, K. Gamble, Otto J. Klotz, J. McAree, V. Sankey, E. Stewart, L. B. Stewart.

SPECIAL COMMITTEES.

Polar Research —Willis Chipman (Chairman), C. J. Murphy A. Niven, W. Ogilvie, J. A. Paterson, L. B. Stewart, J. W. Tyrrell.

Standard Measures of Length.—M. J. Butler (Chairman), G. B. Abrey, W. Chipman, H. D. Ellis, M. W. Hopkins, J. McAree, H. W. Selby.

Biography.—G. B. Kirkpatrick (Chairman), W. R. Aylsworth, Jas. Dickson, H. L. Esten and all exempted members.

PROGRAMME OF THE

Association of Ontario Land Surveyors

(INCORPORATED)

AT ITS THIRD ANNUAL MEETING HELD IN TORONTO,
FEBRUARY 26TH, 27TH AND 28TH, 1895.

PROGRAMME.

Tuesday, February 26th—Morning at 10 o'clock.

Meeting of Council.
Meeting of Standing Committees.

Afternoon at 2 o'clock.

Reading of Minutes of previous meeting.

Reading of Correspondence.

Report of Council of Management (including Reports of Board of Examiners and Secretary-Treasurer). V. Sankey, O. L. S , Chairman, Toronto.

Report of Committee on Publication. K. Gamble, O. L. S., Chairman, Toronto.

Report of Committee on Biography. G. B. Kirkpatrick, O. L. S., Chairman, Toronto.

President's Address.

Paper—" Indexing Office Information." D. D. James, O. L. S., C. E., Toronto.

Paper—" Flood Prevention Work at Brantford." C. C. Fairchild, O. L. S., Brantford.

Paper—" Rainy River District." J. F. Whitson, O L. S , Toronto.

Evening at 8 o'clock.

Report of Committee on Polar Research. Willis Chipman. O. L. S , C. E., Chairman, Toronto.

Paper—" The Eightieth Meridian." Willis Chipman, O L. S., C. E., Toronto.

Paper—" The Objects of Arctic Exploration." L. B. Stewart. O. L. S., D. T. S., Toronto.

Paper—" The Dawson Route." W. A. Browne, O. L. S., Toronto.

Wednesday, February 27th—Morning at 10 o'clock.

Report of Committee on Drainage, with "Question Drawer." Geo. Ross, O. L. S., C. E., Chairman, Welland.

Paper—"Drain Gradient Instrument." A. R. Davis, O. L. S., C. E., Napanee.

Report of Committee on Topographical Surveying. Willis Chipman, O. L. S., C. E., Chairman, Toronto.

Paper—"Aneroids." Otto J. Klotz, O. L. S., D. T. S., Ottawa.

Paper—"Triangulation Work on Topographical Surveys." H. K. Wicksteed, O. L. S., C. E., Cobourg.

Afternoon at 2 o'clock.

Report of Committee on Land Surveying. T. B. Speight, O.L.S., Chairman, Toronto.

Paper—"Co-efficient of Refraction." Otto J. Klotz, O. L. S., D. T. S., Ottawa.

Paper—"Provincial Boundaries." A. Niven, O. L. S., Haliburton.

Paper—"The Cradle Theodolite." J. M. O. Cromwell, O. L. S., Perth.

Evening at 8 o'clock.

ANNUAL DINNER.

F. L. Foster, O. L. S., Chairman of Committee on Entertainment.

Thursday, February 28th—Morning at 10 o'clock.

Report of Auditors.

Report of Committee on Standard Measures, G. B. Abrey, O. L. S., C. E., Chairman, Toronto Junction.

Report of Committee on Engineering—T. Harry Jones, O. L. S., C. E., Chairman, Brantford.

Paper—"Highway Bridges" P. S. Gibson, O. L. S., C. E., Willowdale.

Paper—"Good Streets." H. J. Bowman, O. L. S., C. E., Berlin.

Paper—"Mining." J. D. Evans, O. L. S., C. E., Trenton.

Afternoon at 2 o'clock.

Report of Committee on Entertainment. F. L. Foster, O. L. S., Chairman.

Ratification of New By-laws.

Unfinished Business.

New Business.

Nomination of Officers (President, Vice-President, two Members of Council, Secretary-Treasurer and Auditors).

Appointment of Scrutineers.

Adjournment.

ASSOCIATION OF

ONTARIO LAND SURVEYORS

(INCORPORATED).

MINUTES OF THE THIRD ANNUAL MEETING

(Tenth Annual Meeting of Provincial Land Surveyors of Ontario),

FEBRUARY 26th, 27th and 28th, 1895.

The meeting was called to order at 2 p.m. on Tuesday, the 26th of February, in the lecture room of the Canadian Institute, 58 Richmond Street East, Toronto.

The President, Mr. M. J. Butler, in the chair.

Moved by Mr. Van Nostrand, and seconded by Mr. Niven, that the minutes of last meeting of the Association of Ontario Land Surveyors, as printed in the Proceedings, be confirmed as read. Carried.

The Secretary read a letter from the Editor of "The Surveyor and Municipal County Engineer," of London, England, thanking the Association for the report of last meeting which was sent him, and inviting Ontario Land Suveyors to contribute articles for "The Surveyor;" also one from the President of the Illinois Society of Engineers and Surveyors, regretting that it was impossible to have a representative of that Society at our annual meeting.

Mr. Sankey, on behalf of the Council of Management, asked to be allowed to defer the presentation of their report for the present. He presented the Secretary-Treasurer's report and financial statement which was referred to the auditors.

Captain Gamble presented the report of the Committee on Publication, and moved, seconded by Mr. Selby, that it be adopted. Carried.

Mr. Kirkpatrick, chairman of the Committee on Biography, presented a verbal report, stating that, in answer to the letters sent out to the different surveyors, he had received some thirty-five or forty replies, which contain a great deal of valuable information concerning the surveyors in the early history of this Province. He suggested that the Committee be instructed to correspond with the descendants of some of these old surveyors with a view of obtaining all the information possible regarding them. On the suggestion of Mr. Chipman he read a few of the replies received.

Mr. W. F King, D.T.S., being present, the President extended the courtesies of the Association to him, asking him to take part in the proceedings.

The President then read his annual address.

On motion of Mr. Sankey, seconded by Mr. Dickson, a vote of thanks was tendered the President for his address.

Mr. D. D. James read a paper on " Indexing Office Information."

In the absence of Mr. C. C. Fairchild, his paper on " Flood Prevention Work at Brantford was read by Mr. T. Harry Jones.

In the absence of Mr. Otto J. Klotz, his paper on " Aneroids" was read by Mr. T. Fawcett.

The President announced that on Thursday evening the Alumni Association of the School of Practical Science proposed holding a stereopticon entertainment in that building for the Association of Ontario Land Surveyors if enough members would signify their intention of being present.

The meeting then adjourned at 4.45 p.m.

Tuesday Evening Session, 8 p.m.

The President in the chair.

Mr. J. F. Whitson read a paper on " The Rainy River District."

Moved by Mr. T. B. Speight, seconded by Mr. Jas. Dickson, that a vote of thanks be given Mr. Whitson for his very able paper. Carried.

The Report of the Committee on Polar Research was read by Mr. Willis Chipman, chairman of the Committee.

On motion of Mr. Chipman, seconded by Mr. Dickson, the report was adopted.

Mr. Chipman read a paper on " The Eightieth Meridian."

On motion of Mr. C. F. Aylesworth, seconded by Mr. J. W. Tyrrell, a vote of thanks was given Mr. Chipman for his valuable and interesting paper.

Mr. W. A. Browne read a paper on " The Dawson Route "

The meeting then adjourned, 10.15 p.m.

WEDNESDAY MORNING SESSION, 10 A.M.

The President in the chair.

The report of the Committee on Drainage was read by Mr. Geo. Ross, chairman of the Committee, and was discussed at length.

Mr. A. R. Davis read a paper on "Drain Gradient Instrument," in connection with which he also exhibited a model of his instrument.

The report of the Committee on Topographical Surveying was read by Mr. Chipman, chairman of the Committee.

After considerable discussion, on motion of Mr. Chipman, seconded by Mr. Dickson, the report was adopted.

The meeting then adjourned, 12.45 p.m.

WEDNESDAY AFTERNOON SESSION, 2 P.M.

The Vice-President, Mr. M. Gaviller, in the chair.

In the absence of Mr. H. K. Wicksteed, his paper on "Triangulation Work on Topographical Surveys" was read by Mr H. H. Gibson.

In the absence of Mr. Otto J. Klotz, his paper on "Co-efficient of Refraction" was read by Mr. H. H. Gibson.

On motion of Mr. Dickson, seconded by Mr. Davis, a vote of thanks was tendered Mr. Klotz for his interesting paper.

The report of the Council of Management was then read by Mr. Villiers Sankey.

By laws Nos. 36, 37, 38, 39 and 40, as enacted by the Council, were then ratified by the Association.

On motion of Mr. Sankey, seconded by Mr. Dickson, the report of the Council of Management was adopted.

The report of the Committee on Land Surveying was read by Mr. Speight, chairman of the Committee, and the questions submitted were discussed.

In the absence of Mr J. M. O. Cromwell, his paper on "The Cradle Theodolite" was read by Mr. H. H. Gibson.

The meeting then adjourned, 5.45.

The Annual Dinner was held in the evening.

THURSDAY MORNING SESSION, 10 A.M.

The President in the chair.

Mr. T. Harry Jones, chairman of the Committee on Engineering, said that his Committee had concluded to follow the precedent set in other years and submit no written report. The members, living as they do in various parts of the country, had not been called together during the year. However, some of the papers which have been read before the Society had been procured or given by members of the Committee.

Mr. P. S. Gibson then read a paper on " Highway Bridges."

Mr. J. D. Evans read a paper on " Mining."

Mr. F. L. Foster presented the report of the Auditors, which on motion was adopted.

Mr. H. J. Bowman read a paper on " Good Streets " which was discussed at considerable length.

The meeting then adjourned, 12.30 p.m.

THURSDAY AFTERNOON SESSION, 2 P.M.

The President in the chair.

Moved by Mr. F. L. Foster, seconded by Mr. A. J. Van Nostrand, that the report of the Committee on Entertainment be taken as read and printed in the proceedings. Carried.

Moved by Mr. T. B. Speight, seconded by Mr. M. Gaviller, that any omissions or clerical errors in the records of the proceedings of this meeting, now in the hands of the Stenographer and the Secretary, be corrected by the Committee on Publication before being printed. Carried.

Moved by Mr. Willis Chipman, seconded by Mr. A. Niven, that the Secretary prepare a list of candidates who have passed the Preliminary and Final examinations for Land Surveyors of Ontario since incorporation, this list to give the date of passing and last reported address, and that it be printed in the Proceedings. Carried.

Moved by Mr. G. B. Kirkpatrick, seconded by Mr. F. L. Foster, that the Secretary-Treasurer be granted the sum of one hundred and twenty dollars for his services during the past year. Carried.

Moved by Mr. Chipman, seconded by Mr. C F. Miles, that the Council be and are hereby instructed to fit up the room in the Parliament Buildings granted the Association by the Crown Lands Department in a proper manner for the reception of books, plans, photographs, portraits, documents, instruments, etc., the expenditure for such purpose not to exceed thirty dollars. Carried.

The following were suggested as subjects for papers for next meeting :—

By Mr. P. S. Gibson : " The Survey Act as it stands at present," more particularly with reference to " Sectional Surveys—Double Fronts and Single Fronts." (Suggested by Mr. Dickson.)

By Mr. Niven : " The Eastern Boundary of this Province." (Suggested by Mr. Chipman.)

Mr. Niven explained that he had started to write a paper on "Provincial Boundaries," but found it impossible to finish it in time. He, however, promised to prepare a paper on that subject for next year.

Mr. Gaviller suggested that Mr. H. L. Esten give some information regarding cases which have been decided in the Courts, of interest to the profession, as he had at one time commenced to make a compilation of them. This Mr. Esten said he would be very happy to do.

Mr. Chipman suggested a paper on "The Surveys that were made before 1790 in Ontario."

Mr. Niven suggested that Mr. Dickson give a paper on something in the line of Crown Surveys.

Mr. Speight suggested that Mr. H. D. Lumsden prepare a paper on Railway Work.

Mr. Sankey said he thought it would be well to have an index made of the information contained in the Exchanges and the Reports of the Association and have it printed and sent to each member.

Mr. Chipman thought that this should be done every five years.

Mr. Chipman suggested a paper on "Statute Labor."

Mr. Sankey suggested a paper on "The Areas in Ontario that may be Reclaimed by Drainage."

Moved by Mr. Sankey, seconded by Mr. P. S. Gibson, that the Secretary-Treasurer issue a circular as soon as possible to all members, active and retired, requesting contributions for the repository of any books, plans, pamphlets, field notes, diaries, etc., and any other documents pertaining to the early surveys in Canada, also of old instruments, or other curios of interest to the profession. Each member is also to be requested to forward a photograph of himself, with brief biographical sketch, name and address. Carried.

Moved by Mr. G. B. Kirkpatrick, seconded by Mr. P. S. Gibson, that we have learned with regret of the death, since our last meeting, of Mr. William Robinson, P.L.S., London, Ontario, and we desire to convey to his relatives this expression of sympathy with them in their bereavement. Carried.

Moved by Mr. Chipman, seconded by Mr. Sankey, that the meeting do now adjourn for ten minutes. Carried.

After the adjournment, the nomination of officers was proceeded with.

The President—Last year I suggested that the office of President be for one year only, and that for the future there would be no feeling on the part of any person that he had been cut off summarily. There are many members of the Society who are well fitted for the office of

President, but, in the ordinary course of affairs, it is impossible that it reach all that deserve to be there: therefore, I made that suggestion, and I think we had better bear that in mind now before making any nominations, that it be understood from this date that the President's term be for one year.

Mr. Jas. Dickson moved, seconded by Mr. W. A. Browne, that Mr. Maurice Gaviller be President for the ensuing year.

There being no other nominations, Mr. Gaviller was declared elected.

Moved by Mr. P. S. Gibson, seconded by Mr. Niven, that Mr. Willis Chipman be Vice-President for the ensuing year.

There being no other nominations, Mr. Chipman was declared elected.

As Mr. Gibson and Mr. Chipman were the retiring members of the Council, the following nominations were made to take their places:

Mr. P S Gibson, nominated by Mr. Kirkpatrick, seconded by Mr. Niven.

Mr. James Dickson, nominated by Mr. W. A. Browne, seconded by Mr. Speight.

Mr. Thos. B. Speight, nominated by Mr. Sankey, seconded by Mr Bowman.

Mr. George Ross, nominated by Mr. Van Nostrand, seconded by Mr. Esten.

Mr. J. D. Evans, nominated by Mr. Gaviller, seconded by Mr. Foster.

Mr. W. M. Davis, nominated by Mr. Bowman, seconded by Captain Gamble.

Mr. Harry J. Browne, nominated by Mr. Gibson, seconded by Mr. Speight.

Mr. T. Harry Jones, nominated by Mr. Kirkpatrick, seconded by Mr. W. A. Browne.

Mr. F. L. Foster, nominated by Mr. Chipman, seconded by Mr. Niven.

AUDITORS.

Mr. Jas. Dickson moved, seconded by Mr. M. Gaviller, that the retiring Auditors be re-nominated.

As Mr. F. L. Foster was nominated for the Council, he asked to have his name withdrawn from the nominations for Auditors, and Mr. Gaviller nominated Mr. A. P. Walker in his place as one of the Auditors. There being no other nominations, Messrs. Proudfoot and Walker were declared elected.

Mr. Sankey moved, seconded by Mr. P. S. Gibson, that Mr. Van Nostrand be nominated as Secretary-Treasurer for the ensuing year.

There being no further nominations, Mr. Van Nostrand was declared elected.

The President then appointed Captain Gamble and Mr. W. A. Browne as scrutineers.

On motion of Mr. Sankey, the President then left the chair and Mr. Dickson took it *pro tem.*

Mr. V. Sankey, seconded by Mr. A. Niven, then moved a cordial vote of thanks to the retiring President, Mr. M. J. Butler, for his services as President, and for the trouble he had taken and the valuable assistance he had rendered to the Association, from its commencement to the present time, which was carried unanimously, and to which the retiring President made the following reply:

Mr. Chairman and Gentlemen,—I am sure I thank you very much indeed for the kind manner in which you have received this vote of thanks to me. I appreciate it very much indeed. As suggested by one of our members, I did assist at the birth of this Association, and I attended it through its early infancy, but it has now reached the age of ten years and ought to be able to walk alone pretty strongly. It is getting to be a pretty full-grown boy now, and I think our sphere ought to keep on enlarging and broadening until, as suggested by Mr. Bowman, our surveyors will be, without exception, engineers. Then the reflection that was cast upon surveyors in times past, "Oh, yes. that is the fellow with the Jacob's staff and two or three hundred link chain," will not be hinted at in regard to any member of the Ontario Land Surveyors' Association I thank you indeed for your appreciation of the services I was able to render to the Association, little as they were, during the past year. (Applause.)

On motion of Mr. Dickson, seconded by Mr. Foster, the meeting then adjourned, 4 p m.

MEMBERS IN ATTENDANCE AT THE THIRD ANNUAL MEETING.

Abrey, G. B.
Aylsworth, C. F., jr.
Beatty, W.
Bowman, C. D.
Bowman, H. J.
Browne, H. J.
Browne, W. A.
Butler, M. J.
Chipman, W.
Davis, A. R.
Davis, J.
DeGurse, J.
Dickson, J.
Ellis, H. D.
Esten, H. L.
Evans, J. D.
Fawcett, T.
Foster, F. L.
Gamble, K.
Gaviller, M
Gibson, H. H.
Gibson, P. S.
Hutcheon, Jas.
James, D. D.
Johnson, R. T.
Jones, T.
Kirkpatrick, G. B.
Laird, R.
Lumsden, H. D.
McFarlen, G. W.
McMullen, W. E.
Miles, C. F.
Murphy, C. J.
Niven, A.
O'Hara, W. F.
Proudfoot, H. B.
Robertson, Jas.
Ross, G.
Selby, H. W.
Sankey, V.
Sewell, H. DeQ.
Silvester, G. E.
Speight, T. B.
Stewart, L. B.
Spry, W.
Tyrrell, J. W.
Unwin, C.
VanNostrand, A. J.
Walker, A. P.
Wheelock, C. R.
Whitson, J. F.

RESULT OF ELECTIONS.

President..............M. Gaviller..............(by acclamation).
Vice-President..........Willis Chipman..........(by acclamation).
Secretary-Treasurer......A. J. VanNostrand......(by acclamation).

Councillors elected for ensuing three years.

P. S. Gibson, F. L. Foster.

Auditors for ensuing year (by acclamation).

H. B. Proudfoot, A. P. Walker.

I hereby declare the above-named Councillors and Auditors elected.

A. J. VanNostrand,
Secretary-Treasurer.

Certified correct.

Killaly Gamble,
W. A. Browne,
Scrutineers of Ballots.

REPORT OF THE COUNCIL.

The Council met in April and November.

At the April meeting, By-Laws Nos. 36, 37, 38 and 39 were passed, under the authority of By-Law No. 33, and at the November meeting By-Law No. 40 was passed under the same authority, and are now reported to the Association for ratification or otherwise. At the meeting of the new Council in April Mr. Sankey was elected chairman, and Messrs. Gaviller and Coad were appointed as members of the Board of Examiners. The several Standing Committees were appointed, as provided in By-Law No 5. (See Report 1894, p. 6). It was also resolved by the Council to print the examination papers, as far as practicable, of November, '93, in the report. This has been done at a cost of about $20, and the Council hopes that the Association will concur in this practice being continued in future for the following reasons: 1. The publishing of these papers gives intending candidates opportunity of preparing themselves properly for the Examinations. 2. It shews to the members of the Association the manner in which the Board of Examiners is carrying out its duties, and gives opportunity to suggest improvements in the style and scope of the Examinations. 3. The enhanced value of the Report which has been already favourably commented on, and also the evidence these papers bear, that to become an Ontario Land Surveyor a candidate must be well grounded in the several subjects required. It may be here stated that an oral examination is required as well in each subject.

The Council, knowing that a large amount of information of interest to the profession is scattered throughout the Province, and that the first move in order to collect it was to secure a convenient repository for the same, an application was therefore made to the Hon. the Commissioner of Crown Lands for the use of some room in the New Parliament Buildings, the result being that he has most kindly placed a suitable room, fitted up with shelves, tables and chairs, at our disposal. We are now in a position to keep an index, plans, maps, books, instruments, etc , and the members of the Association are earnestly requested to further the enterprise by securing for this repository donations of such information, instruments, etc., as they may think of interest. The use of the room and benefit of the information will be always at the disposal of all our members.

With regard to the election of the several officers the Council would suggest that the Association will consider the advisability of permitting members, who are unable to attend the annual meeting, to send in their nominations in writing. This would tend to increase the interest of members from all parts of the Province. As there may, however, be reasons why this plan will not work, the Council hopes the matter may be fully discussed before being adopted.

The plan of printing some of our papers before the Annual Meeting has been tried this session.

It is recommended that in future all papers for the annual meeting of the Association be sent to the Secretary by February 1st, in order that they may be printed and mailed to the members at least a week before the annual meeting, and that discussions be written out and sent in by the members, or personally read by them after the reading of the paper.

In response to Circular No 16, the Secretary has received many replies which shew that in some places unlicensed men are now practising. The Council has decided to enquire into these cases, and to prosecute in all cases where the evidence will warrant such action. Any member able to assist in giving information, or the names of persons from whom such information may be had, will please communicate at once with the Secretary.

The Reports of the Board of Examiners and of the Secretary-Treasurer are herewith presented, having been adopted by the Council The Council has again to record the high appreciation of the energy and ability with which the Secretary-Treasurer discharges his many and, in some cases, onerous duties.

Respectfully submitted.

VILLIERS SANKEY,
Chairman of Council.

NEW BY-LAWS.

By-Law No. 36. "The following Surveyors having duly registered, and having proved to the satisfaction of the Council that they had been respectively, in actual practice as duly authorized and qualified Land Surveyors for Ontario for a period of not less than 35 years prior to July 1st, 1892, are hereby placed on the list of registered Surveyors for Ontario, and are exempt from the payment of further dues under the authority of sub-section 4 of section 10, Chapter 34, Ontario Statutes, 1892, viz., Thomas Coltrin Keefer, Nathaniel Edward Low, Thomas Cheesman, James McCallum and Thomas W Walsh." Passed by Council of Management, 4th April, 1894.

By-Law No. 37. "Whereas it has been proven to the satisfaction of the Council that Royal Wilkinson Hermon was granted a certificate as Provincial Land Surveyor, dated 13th July, 1857, and had therefore been a duly qualified Land Surveyor for 35 years, less 12 days, prior to the first day of July, 1892 ; it is therefore enacted that the said Royal Wilkinson Hermon is hereby granted exemption from dues under the authority of sub-section 4 of Section 10, Chapter 34, Ontario Statutes, 1892." Passed by Council of Management, 4th April, 1894.

By-Law No. 38. "Whereas it has been recommended by the Board of Examiners that the minimum marks in the subject of levelling be reduced from 40 to 35, it is therefore hereby enacted that the minimum number of marks required to be taken by each successful candidate in the subject of levelling shall be 35 instead of 40 as set forth in By-Law No 29." Passed by Council of Management, 4th April, 1894.

By-Law No. 39. "Whereas any registered surveyor desiring to give up practice can have his name removed from the registered list of practitioners at any time, upon giving written notice of such desire, and whereas it is desirable that such surveyors may contribute papers and secure the reports of the transactions of this Association and exchanges, therefore this Council hereby enacts that such surveyors shall have the aforesaid privileges upon the payment of an annual fee of two dollars, and their names shall be printed in the list of members in the annual report of the Association and properly marked." Passed by Council of Management, 7th April, 1894.

By-Law No. 40. "The following surveyors having duly registered and having proved to the satisfaction of the Council that they had been respectively in actual practice as duly authorized and qualified land surveyors for Ontario for a period of not less than thirty-five years prior to July 1st, 1892, are hereby placed on the list of registered surveyors for Ontario and are exempt from the payment of further dues under the authority of sub-section 4, of section 10 chapter 34, Ontario Statutes, 1892, viz., Tom S. Rubidge and James A. Gibson." Passed by Council of Management, 6th November, 1894.

REPORT OF THE BOARD OF EXAMINERS.

The Board of Examiners met in April and November, when the following candidates passed, the finals being sworn in, and the following bonds were approved and filed with the Provincial Registrar. (See lists below.)

One candidate failed in April, and two others were required to take a supplemental examination in two subjects each.

A list is also presented showing the names of the various students who have filed articles and with whom they are now serving. This will bring the list, which was published in the Report of 1893, pages 154-5, up to date.

The Board, in order to reduce the cost of the examinations, decided that $5 00 per day would be the fee payable to the members for the April meeting, and that attendance of the examiners should be so regulated that just a sufficient quorum might be in attendance. This has reduced the cost, and was found to be workable when there were not a great many candidates.

Respectfully submitted,

Villiers Sankey,

Chairman of Board.

LIST OF ARTICLED PUPILS.

NAME OF PUPIL.	NAME OF SURVEYOR.	RESIDENCE.	DATE OF ARTICLES	TERM
Heaman, John Andrew	Moore & Henry	London	9th November, 1893,	Three years
Chalmers, William James	Rorke, Louis Valentine	Sudbury	31st March, 1894	One year.
Ardagh, James Arthur Gowan	Bowman, Herbert Joseph	Berlin	10th May, 1894	One year.
Mitchell, Charles Hamilton	Tyrrell, James Williams	Hamilton	17th May, 1894	One year.
Bergey, Aaron E.	Bowman, Herbert Joseph	Berlin	4th June, 1894	One year.
Chalmers, John	Burke, William Robert	Ingersoll	1st July, 1894	One year.
MacLean, William Arthur	Campbell, Archibald William	St. Thomas	4th April, 1894	Three years.
Ford, William Butterton	Davis, William Mahlon	Woodstock	4th April, 1894	Three years.
Gillon, Douglas John	McCallum, James	Rat Portage	16th June 1894	One year.
Squire, Richard Herbert	Jones, Thomas Henry.	Brantford	20th July, 1894	One year.
Newman, John James	Newman, William	Windsor	4th April, 1894	Three years.
Ward, Archeson Thomas	Speight & VanNostrand	Toronto	4th April, 1894	Three years.
Fairbairn, John M. R.	Wilkins, Frederick William	Peterborough	4th June, 1894	One year.
Gibson, Wilbert Silas	Gibson, Peter Silas	Willowdale	5th April, 1894	Three years.
McNaughton, Finlay Donald	Brown, David Rose	Cornwall	5th April, 1894	Three years.
Mackenzie, William	Baird, Alexander	Leamington	23rd January, 1894	One year.
Brown, George Laing	Brown, David Rose	Cornwall	2nd April, 1894	One year.
McPherson, Archibald John	McCulloch, Andrew Lake	Galt	28th March, 1894	One year.
Johnson, Sydney Munnings	VanBuskirk, William Fraser	Stratford	24th October, 1894	One year.
Smith, Angus	Scane Thomas	Ridgetown	18th December, 1894	One year.

APRIL EXAMINATION.

Preliminary.

Bow, James Alexander	Orillia.
Gibson, Wilbert Silas	Willowdale.
MacLean, William Arthur	St. Thomas.
McNaughton, Finlay Donald	Cornwall.
Ford, William Butterton	London.
Ward, Archeson Thomas	Toronto.
Newman, John James	Windsor.

Final.

Fairchild, Charles Court	Brantford.

NOVEMBER EXAMINATION.

Preliminary.

No candidate.

Final.

Allan, John Richard (Supplemental).

BONDS—APRIL, 1894.

Harvey, Thomas Alexander.
McLennan Murdoch John.
Hopkins, Marshal L. Willard.

NOVEMBER, 1894.

Fairchild, Charles Court.

REPORT OF THE SECRETARY-TREASURER.

Mr. Chairman,—In compliance with the By-laws, I beg to present the following report of the official proceedings of the Association, as transacted by my department between February 26th, 1894, and February 25th, 1895:—

The following circulars have been issued:

No. 14.	Ballot for 1894-5	225 copies
" 15.	Explanation of Ballot	225 "
" 16.	*Re* Court Decisions, etc	225 "
" 17.	*Re* Biographical Sketches	40 "
" 18.	Announcement of Annual Meeting, 1895	250 "
" 19.	Programme for " " "	325 "

Letters and Accounts sent from Secretary's office	709
Postal Cards " " "	50
Letters, Postal Cards and Biographical Sketches received	479

The Register stands as follows:

Active members, subject to dues	197
" " exempted from dues	16
Withdrawn from practice	43
Dead	2
Total number of registrations	258

The following table shows the present location of both "active" and "withdrawn" members :—

County or District.	*Active Members.*	*Withdrawn Members.*
Algoma	2	
Brant	3	
British Columbia		10
Bruce	4	
Carleton	11	5
Dufferin	2	
Durham	1	
Dundas	1	
Elgin	4	
Essex	7	
Frontenac	4	
Grey	3	
Grenville	1	
Glengarry	1	
Haliburton	1	
Halton	2	
Hastings	4	
Haldimand	2	
Huron	2	
Kent	8	
Lambton	5	
Lanark	4	
Leeds	3	
Lennox	4	
Lincoln	1	1
Middlesex	10	
Manitoba	1	6
Manitoulin	1	
Muskoka	4	
Nipissing	4	
Norfolk	2	
North-West Territories		6
Northumberland	4	
Ontario	3	
Oxford	4	
Parry Sound	1	
Peel	1	
Perth	7	
Peterboro'	4	2
Prince Edward	1	
Quebec		3
Renfrew	5	
Russell	1	
Rainy River	4	
Simcoe	7	1
Stormont	2	
Thunder Bay	4	
Victoria	3	
Waterloo	4	1
Welland	1	
Wellington	5	
Wentworth	7	1
York	35	6
United States	5	4

Number of Candidates passed Final Examination	2
" " " Preliminary Examination	7
" Pupils filing Articles	19

The demand for our Annual Reports having increased, it was deemed advisable to enlarge the issue to 1,150, 1,046 of which were sent to exchanges, members, advertisers, libraries, newspapers, etc., and 104 remain on hand.

Single copies have been sent by request to the following institutions, viz. :—

Public Library, Toronto.
Canadian Society of Civil Engineers, Montreal.
Library of Parliament, Ottawa.
Meteorological Office, Toronto.
Ontario Department of Crown Lands, Toronto.
Ontario Bureau of Mines, Toronto.
Ontario Department of Agriculture, Toronto.
City Engineer, Toronto.
Association of Provincial Land Surveyors of British Columbia, Victoria, B.C.
Engineers' Society of Western Pennsylvania, Allegheny, Pa.
Cornell University, Ithaca, N.Y.
Massachusetts Institute of Technology, Boston, Mass.
State Normal and Training School, Cortland, N.Y.
University of Minnesota, Minneapolis, Minn.
Thayer School of Engineering, Hanover, New Hampshire.
Correspondence School of Mechanics, Scranton, Pa., and

The Surveyor, London, England, and in nearly every instance at least one volume has been received in exchange. The Editor of *The Surveyor* has kindly continued the name of our Association on the weekly mailing list in exchange for a single copy of our report. It is hoped that in exchange for this courtesy some of our "sanitary" members will contribute, as requested in the letter of the Editor, to the sanitary columns of that valuable publication.

In addition to the single exchanges mentioned above, our library has been further enriched through the generosity of Mr. Chipman by 56 bound and unbound volumes, a catalogue of which has been made.

Another member of the Council of Management has also kindly donated a set of charts from the United States Hydrographers' Department, showing the St. Lawrence River from its mouth to Ile de Grace.

Now that we have secured a safe repository for our library, and other properties, in the Crown Lands Department, it is hoped that others will contribute in the form of books, maps, old instruments, or curios, of interest to the profession.

Accompanying this report is a statement of the receipts and expenditures for the association during the past year, which, when duly audited, will be presented

All of which is respectfully submitted.

A. J. VanNostrand,
Secretary-Treasurer.

Toronto, 25th February, 1895.

STATEMENT OF RECEIPTS AND EXPENDITURES BETWEEN 26TH FEBRUARY, 1894, AND 25TH FEBRUARY, 1895.

1894-5.	RECEIPTS.	
To balance on hand 26th February, 1894		$752 94
" Amounts collected from advertisements in '93 Report	$ 25 00	
" " " " '94 "	75 00	
		100 00
" Proceedings sold, 7 copies and postage		3 60
" 10 Registration fees, at $1	$ 10 00	
" 1 Annual Dues for 1st Association year, $4.00	4 00	
" 14 " " 2nd " " "	56 00	
" 148 " " 3rd " " "	592 00	
" 1 " " 4th " " "	4 00	
		666 00
" Interest accrued on $511.09 in Savings Bank		18 00
" Surplus from Board of Examiners' account		163 10
Total		$1,703 64

1894-5.	EXPENDITURES.	
By postage		$ 56 10
" Bank collections		75
" Printing circulars, wrappers, stationery and biographical blanks		50 85
" Publishing Report of Proceedings 1894 Annual Meeting		290 60
" Freight on exchanges received		2 41
" Customs brokerage on exchanges received		2 00
" Amount paid to Secretary-Treasurer for 1893		120 00
" Amount paid to Stenographer for 1894 meeting		35 00
" Rent of Rooms for 1894 meeting		10 00
" Blank books and forms		6 40
" Extra numbers of 1893 exchanges		39 80
" Extra numbers of 1894 exchanges		38 95
" Expenses of Council Meetings, April and November		10 00
" Expenses on copies of 1886 Report recovered		1 00
" Money orders when paying for 1893 exchanges		40
" Repairs to typewriter		35
" Amount paid for packing and shipping to exchanges		3 90
" Amount paid for tin box for papers		2 50
		$ 671 01
" Balance on hand in Savings account	$529 09	
" Balance on hand in current account	503 54	
Total balance		1,032 63
Total		$1,703 64

A. J. VanNostrand,
Secretary-Treasurer.

REPORT OF AUDITORS.

We hereby certify that we have examined the accounts of the Secretary-Treasurer and vouchers therefor, as well as the financial statement, and have found them correct.

H. B. Proudfoot, } *Auditors.*
Fred. L. Foster, }

Toronto, 25th February, 1895.

DISCUSSION.

Mr. Dickson—I think that idea of having the papers sent in several weeks before the meeting of the Association and printed is a capital one. It is a very difficult thing for any member who has never heard about a certain subject to get up and discuss it intelligently. In this way he can get his remarks ready beforehand, and either deliver them orally or read them out before the meeting. The only danger is that some of us might make it too long. I am afraid I would be inclined to do that myself. But I think if we made it just as short as we possibly could and made it sufficiently plain it would be a good thing.

Mr. Gaviller—I quite agree with what has been said. It would put the discussion in better shape and make it more intelligible.

Mr. Sankey—The principal object in making the suggestion was that we find as a rule the discussion is limited to the front benches; the men sitting in the back part of the hall are all more or less of a retiring and timid nature and they don't like to speak Then there is another class of men; they are the ones who know most about the subject probably, but don't like to make a statement that may hereafter be brought up against them. It may not be known that men of the legal profession look over our reports, and it may sometime be said: ' Well, you made such and such a statement in the Surveyors' meeting; are you prepared to go back on that?" You know we are not just merely a "little" meeting now-a-days; we have some weight in the country. We don't want to check discussion at all, but we want to give an opportunity of having a sensible and really business-like discussion on the various papers brought before us.

About the room we have secured in the Parliament Buildings, I think it is well to add that it is a very convenient room. The key will be in Mr. Kirkpatrick's office. We hope to make a collection of books of all kinds. We also wish to make a collection of maps and plans of all parts of the Province, or other countries. People sometimes want to get a look at a map that is not found in Canada. I know we can get maps from the various departments in Ottawa and Ontario that are useful for surveyors to have a look at; also old instruments, etc. We have already had a donation in that line. I would like to ask some of you to go up and look at the room.

Mr. Gaviller—There is a point I would like to draw attention to, that is as to members who find it impossible to attend the meeting sending in nominations in writing. They feel as it is that they are cut out entirely from taking any part in the nominations until the ballot is sent in, and then they find somebody perhaps whom they would like to see a candidate is not mentioned at all. I would like to hear the sense of the Association on that, because you all may be affected by it some day.

Mr. Sankey—I was in hopes that this matter would be discussed. In many cases members fail to send in their ballot papers marked for any one. They say simply: "We don't know any of the gentlemen proposed, and so we don't care to vote for them particularly," and I think in that way interest is to a certain degree lost in some sections of the Province. If these nominations could be received by the Secretary before the annual meeting, he could read them out when the ordinary nominations are being made. There is just one point, I think, we ought to take into consideration in managing an Association of this kind where the members are so very much separated. A certain amount of concentration is undoubtedly necessary. We must be within reach of a certain quorum of our Council as the governing body of the Association. It is just possible that these nominations may have the effect of distributing the Council so far apart that practically the whole business of the Association would have to be done by letter writing. Of course, a great deal can be done in that way, but you can all understand it is very advisable to be able at times to discuss matters that will probably have to be discussed at two or three different meetings before anything arises out of them.

Mr. Speight—Do you know if that method of nominating candidates is adopted by any other Association ?

Mr. Sankey—I can't answer that question ; I don't know positively. But you know that our election is by post, so that, arguing from that backward, there is no reason why the nomination should not be by letter. We are not interfering with the electing powers of the Association at all, but we thought it advisable to bring this up for discussion.

Mr. Dickson—Supposing I should send in a nomination that was not seconded ?

Mr. Sankey—Up to the present we have received nominations for the Council without a seconder. As a rule, our President and Vice-President have been elected by acclamation by standing vote in the room. Well, somebody might put in a name in a letter, and that would prevent the nomination being unanimous. As a rule, the Vice-President has been made President, and we have found it works very well so far. There is just a little feeling in some parts of the Province that they have not a chance of nominating men that they would like to vote for, but that could easily be done by writing to some member of the Association and asking him to propose so and so.

Mr. Dickson—I think there has always been a very fair representation here, and I have never heard anything said in the way of complaint at not having had a share in the nomination. Parties might send in a nomination and cause a great deal of trouble. I think those who take the trouble to come here, some a considerable distance—and I am sorry that more don't come—I think they should certainly have the privilege of nominating officers when all the members of the Association are equally asked to record their votes.

Mr. Sewell—I think the best thing is to leave well alone. Our nominations should be made here in the room. I think it is far the better way.

Mr. Gaviller—The Council are not going to act in haste in this matter, and that is one reason why Mr. Sankey and the Council are anxious to hear your opinion on it.

The report of the Council was then adopted.

REPORT OF PUBLICATION COMMITTEE.

Mr. President,—This Committee has had but little to occupy it save the usual routine of business.

Eleven hundred and fifty copies of the Report of the Proceedings were printed by the Presbyterian Printing and Publishing Company at a cost of $290.60, being rather more than in former years, as the illustrations were more expensive, and the examination papers were added to the Report.

We continue to exchange our reports with other societies as in the past.

Members sending in "Papers" for publication are requested to have the accompanying diagrams accurately drawn on a scale suitable for insertion in the Report.

It is most desirable that all members of our Association would endeavour to forward the interests of our advertisers in every way in their power.

Exchanges, Sent to

Iowa Civil Engineers and Surveyors' Society	55	copies.
Illinois Society of Engineers and Surveyors	100	"
Michigan Engineers' Society	140	"
Ohio Society of Surveyors and Civil Engineers	130	"
Indiana Engineering Society	130	"
School of Practical Science Engineering Society	200	"

Respectfully submitted,

Killaly Gamble,
Chairman.

REPORT OF COMMITTEE ON BIOGRAPHY.

(Verbal Report. See Minutes).

REPORT OF COMMITTEE ON POLAR RESEARCH.

Mr President,—At the last meeting of this Association a committee of seven was appointed for specific purposes mentioned in the resolution which will be found on page 13 of the 1894 Report of Proceedings.

The purposes for which this Committee was appointed have not been interpreted literally by the Committee, but in a broader spirit.

This Committee has been an active one, all the members taking a keen interest in the problem.

We are of opinion that the Canadian Land Surveyors are better fitted for Arctic research than any other class of people on the globe, accustomed as they are to low temperatures, the use of toboggans, snowshoes and dog teams—fertile in resources, patient under adversities.

Your Committee would strongly urge upon the members of this Association to acquaint themselves fully with the history and geography of "Arctic Canada" and to give moral support to the promoters of Canadian expeditions.

Your Committee presents herewith letters from Professor Angelo Heilprin, President of the Geographical Club of Philadelphia, who relieved Lieutenant Peary in 1893, respecting the organization of an expedition to relieve him in the summer of 1895.

From this correspondence it will be seen that the Association of Ontario Land Surveyors can send a representative in this expedition by contributing $1,000 towards the cost. While we believe that it would be foolish to send an expedition composed of inexperienced men north of latitude 80°, we do not think the Association can at present afford to contribute the large amount required to gain a summer's experience. We hope that there will arise from among our members some few who will volunteer to spend a year in North Greenland or Grinnel Land to gain the experience necessary before attempting exploring north of latitude 83°, and that the Association will contribute something towards the cost of outfit.

We are of opinion that our Governments, Federal and Provincial, will not consent to expend any large amount upon any exploring scheme that promises so little in return as a polar expedition. We must stimulate the patriotism of some of our wealthy men, upon whose liberality we must rely for the necessary funds, but we cannot appeal to them until we can prove the fitness of our men for the work. The men selected must have spent at least one year within the Arctic Circle in America before assuming to lead an expedition. Volunteers for this work must be physically and mentally robust, possessed of indomitable will power, and must be prepared to sacrifice two or three years at least in a life of hardship

The party should not be large—say 12 men all told—supplied with three years' provisions, sledges, boats, dogs, snowshoes, etc., etc. The cost of such an expedition should not exceed $50,000 (possibly half this would do), a large part of which must go towards chartering a vessel to take the party and all supplies as far north, *via* Smith Sound, as possible.

For the present the Association can do nothing, but the individual members can awaken public interest in Arctic Canada, and arouse enthusiasm by recounting the adventures of the many noble men who have explored the north coast of America and the archipelago of islands to the north of it.

With the hard-fisted utilitarian we cannot afford time to argue. We can only refer them to the long list of talented, educated and brave men who spent years in Arctic research.

Frobisher, Hudson and Baffin were representative of the seventeenth century. In the next hundred years Behring discovered the strait between Asia and America, Wrangell the land named after him, while Hearn and Mackenzie explored the central part of British America.

In our own century we have Scoresby, Ross, Parry, Franklin, Back, Dease, Simpson, Richardson, Rae, McClure, Collinson Penny, Austen, Belcher, Osborn, Kellatt, McClintock, De Haven, Dr. Kane, Hall, Koldeway, Nordenskiöld, Payer, Weyprecht, Smith, Nares, Markham, Schwatka, De Long, Greely, Lockwood, Nansen, Peary.

This list is not a complete one, but we cannot read the history of the lives of those men without a feeling of pride to know that the great majority are of the Anglo-Saxon race, whose example we should not hesitate to follow. We should not rest until British North America has been fully explored and mapped This large region probably contains the largest area of unmapped territory in the world, not excepting Central Africa, the Sahara, or North-western Australia.

WILLIS CHIPMAN,
Chairman.

REPORT OF COMMITTEE ON DRAINAGE.

MR. PRESIDENT,—Your Committee on Drainage beg to report as follows:

For the past few years the whole drainage question in this Province has been most carefully investigated in all its bearings with the object of having the laws respecting the same drawn up so as to meet any case that might arise, in a manner that would do justice to all parties, and clearly indicate on what lands and in what proportion the cost of constructing and maintaining drainage works should be levied without draining the pockets of the owners of the lands instead of their lands by unnecessary litigation. As a result of all this painstaking research, The Ditches and the Watercourses Act, of 1894, became the law of this Province on the fifth day of May last, and an Act to consolidate and amend the Drainage Laws, received the royal assent at the same time, and came into operation on the first of June. Drafts of these Acts were sent out in 1893 to "councils, surveyors, public officers, etc., etc., with a view to the expression of public opinion thereon," and at the Annual Meeting of this Association a year ago the Drainage Committee only suggested a few comparatively unimportant changes, but these, with one solitary exception, met an untimely fate. However, several important amendments were made in the bills before finally becoming law in 1894, among which may be mentioned the changes in Sections 59 and 60 of the Drainage Act, when work is extended into another municipality. The Act of 1894 provides for the initiating municipality to complete the whole work, instead of having each municipality extend the drain beyond its limits as was proposed in the draft of 1893.

A corresponding change was not made in Sections 69 and 70 as to maintenance of a drain continued into or through more than one municipality but each municipality is to maintain the portion in such municipality at the expense of the lands and roads in any way assessed for the construction thereof and in the proportion determined by the engineer, or surveyor, in his report and assessment for the original construction. This may seem simple enough but in actual practice there is reason for careful enquiry. Suppose a case where the drain is continued into three municipalities, and any one township repairs the portion therein, should the lands in all three townships be assessed for the work done in any one? This would be perfectly fair only when the repairs are undertaken in all three municipalities about the same time.

In the Ditches and Watercourses Act an important change was made in Sec. 5 of the 1893 draft, as to the limit of the work which enables a drain to be extended without a petition into seven instead of five original township lots, and considerably increases the "one man's power" of which so much is heard at meetings under this Act, where there is opposition to the proposed work

Some cases have already come up before the referee, where assessments have been made under Sub-Secs. 3 and 4 of Sec. 3 of the Drainage Act of 1894, but we do not know of any where the decision has yet been given. It has been found very difficult to distinguish between "outlet liability" and "injuring liability." Sub-Sec. 5 of Sec. 3 specifies that the assessment for injuring liability and for outlet liability shall have regard to the speed of the water artificially caused to flow upon the injured lands or into the drainage work Does this mean the speed with which the drainage work carries off the water from the lands or roads liable for such assessments? The principles that guide the relative amount of assessment for "benefit" and outlet seems as elusive as ever and will probably be fought over and over again in the courts.

Sub-Sec. 4 of Sec. 3 provides for assessing the lands and roads of any municipality, company or individual using any drainage work as an outlet, either directly or through the medium of any other drainage work, or a swale, ravine, creek or watercourse. The interpretation of this has already been argued before the referee. Does this in any case cover the cost of works constructed before the Act came into force? Can uplands, draining through a large swale, with no perceptable current, be assessed? From the decisions that may be given, these questions may be answered a year from now. In the meantime your Committee would ask all members to send full notes on all decided cases of any importance to the Chairman of the Drainage Committee; otherwise many interesting points of much value may not become known to the majority of the members. Owing to the changes made in the Drainage Act, the decisions in several cases that have been tried during the last year or two, are not of so much value as they would otherwise be, but they all shed a certain amount of light on the miry path and a list of several is hereto appended with some notes or extracts from the digest in the law reports.

On the whole about an average amount of drainage work was undertaken during the past season, and the new Acts are considered to be a decided improvement on the former drainage laws and when better understood will no doubt prove very satisfactory.

All of which is respectfully submitted,

GEO. ROSS,
Chairman.

22 Ont. Reports, p. 664.

Re Suskey and the Corporation of the Township of Romney. Argued Nov. 22, 1892, before Boyd, C.

A by-law amending a drainage by-law under Sec. 573 of the Consolidated Municipal Act, 1892, " in order fully to carry out the intention thereof " where sufficient funds have not been authorized by the original by-law, is one which provides for the completion of the work, so as to make it efficient, although there may be some deviations and variations, or even additions to the work as originally planned.

During the construction of the drain it was found that stone portals were needed for the work, and that the outlet to the lake had to be deepened, and certain other extra work and necessities were recommended by the engineer. *Held* that the by-law providing for them was an amending by-law under Sec. 573 of the Consolidated Municipal Act, 1892, and that the township council had power to pass it under that Section.

23 Ont. Reports, p 651.

Queen's Bench Division, Williams *v* Richards *et al.*

WATERS AND WATERCOURSES.

That cannot be called a defined channel or watercourse which has no visible banks within which the water can be confined, and an occupant or owner of land has no right to drain into his neighbour's land the surface water from his own land, not flowing in a defined channel.

The rule of the civil law that the lower of two joining estates owes servitude to the upper to receive all the natural drainage, has not been adopted in this Province.

Judgment by Robertson J. at Chatham Spring Sittings, 1893, confirmed by Divisional Court, June 10, 1893

23 Ont Reports, p. 99.

COMMON PLEAS DIVISION.

Close *et al*, *v*. the Corporation of the Town of Woodstock. Tried before Falconbridge J., 12 March, 1891.

A Municipal Corporation having constructed a drain without by-law for a particular portion passing through private property whereby noxious matter was brought down and deposited thereon, was held liable for damages sustained thereby, notwithstanding that there were excavations on the land but for which the noxious matter might have passed off ; the owner not having been bound to leave his land in a state of nature ; nor was it answer that the drain was used for similar purposes by others as well as the corporation. In such a case the remedy is by action and not by submission to arbitration.

24 Ont. Reports, p. 12.

QUEEN'S BENCH DIVISION.

York *et al. v.* Township of Osgoode *et al*, Ditches and Watercourses Act.

Where the engineer of a Municipal Corporation purports to make an award under the Ditches and Watercourses Act, with respect to the making of a drain, the affirmance of such award by the County Court Judge does not preclude the High Court from entertaining the objection that the engineer had no jurisdiction to make the award, nor is such an objection one for the CountyCourt Judge.

The decision by the County Court Judge as to matters over which the engineer has jurisdiction cannot be reviewed by the Court; and whether the plaintiffs were benefited by the proposed work was a matter to be determined by the engineer and subject of appeal to the County Judge.

Judgment by Falconbridge J., 12th May, 1893. Confirmed by Divisional Court, June 10, 1893.

In this case a majority of the owners were required under the Act of 1883, and it was held that "owners" were persons assessed as such.

21 Ont. Appeal Reports, p. 168.

At the Court of Appeal, April 16, 1894, it was decided that "owners" were actual, not assessed owners. This reversed the decision of the lower court, but the term "owner" is now defined in the Act of 1894.

25 Ont. Reports, p. 399.

CHANCERY DIVISION.

Re Jenkins and the Corporation of the Township of Enniskillen.

A township council, finding that a government drain in the township did not carry off the water by reason of the natural flow being in another direction, accepted a report made by their engineer, and passed a by-law adopting a scheme for a new drain, leading from the middle of the government drain into an adjoining township, where it was to find an outlet:—

Held, that the proposed drain properly came within the description of a new outlet, although not at the end of the government drain, and although the former outlet remained to serve to carry off a part of the water; and so long as the proposed drain was designed merely as an outlet for the water from the government drain, it might, under Sec. 585 of the Municipal Act. of 1892, be provided for without any petition under Sec. 569, even although it should incidentally benefit the ocality through which it ran, nothing being included in the plan beyond what was reasonably requisite for the purpose intended.

Although a township council is not powerless with regard to the prainage report of its engineer, it is contrary to the spirit and meaning of the Act that two adjoining councils should agree upon a drainage scheme and upon the proportion of its cost to be borne by each, and that the engineer of one of them should be instructed to make a report to carry out the scheme and charging each municipality with the sums agreed on; for such a course would interfere with the independent judgment of the engineer, and pledge each township in advance not to appeal against the share of cost imposed upon it, to the possible detriment of the property owners assessed for the portion of that share.

And where such a course was pursued, a by-law of one of the councils, adopting the engineer's report, was quashed.

In describing lands for assessment "the north east part," even with the addition of the acreage, is an ambiguous description; and *quære* as to the effect upon the validity of a by-law.

Judgment by Street J., July 21, 1894

25 Ont Reports, p. 465.

COMMON PLEAS DIVISION.

The Canadian Pacific Railway *v* the Corporation of the Township of Chatham

Cost of culvert built by railway under agreement with defendants at a cost of a little over $200. Agreement held to be ultra vires and not coming under Sec. 573.

Judgment by Street J., June 15, 1893, and affirmed by Divisional Court, Rose J., dissenting.

30 Law Journal.

P. 105, Dagenais *v* Corporation of Trenton; p. 687, Stephens and the Township of Moore; p. 730, Harwich and Raleigh.

20 Ont. Appeal Reports, p. 225

Hiles *v.* Ellice, Crooks *v.* Ellice.

23 Supreme Court of Canada, p. 429.

Upon reference of an action under the Drainage Trials Act of Ontario (54 v. c. 51) whether, under Sec. 11, or Sec. 19, the Referee has full power to deal with the case as he sees fit and to make of his own motion all necessary amendments to enable him to decide according to the very right and justice of the case and may convert the claim for damages under Sec. 11 into a claim for damages arising under Sec. 591 of the Municipal Act.

The referee has no jurisdiction to adjudicate as to the propriety of the route selected by the engineer and adopted by by-law, the only remedy, if any, being by appeal against the project proposed by the by-law.

A municipality constructing a drain cannot let water loose just inside or anywhere within an adjoining municipality, without being liable for injury, caused thereby in lands in such adjoining municipality.

21 Ont. Appeal Reports, p. 504.

Gibson *v.* Township of North Easthope.

Judgment 30 June, 1894, reversing decision of Queen's Bench Division. Withdrawal from petition.

Township of Rochester *v.* Townships of Mersea and Gosfield.

This was a case in which the Township of Rochester undertook to repair that portion of the Ruscom drain in their township which was constructed originally under a by-law of the County of Essex, and under which certain lands in Mersea and Gosfield were assessed, as well as the lands in Rochester, certain work at that time having been performed in Mersea and Gosfield.

The points raised were that the referee had no jurisdiction, and that if he had, the work was legal under the old Act, and upon the facts the appeal should be dismissed, in this the referee held that he had jurisdiction, and dismissed the case upon the facts, Rochester from this decision of the referee, appealed to the Court of Appeal, in which the referee was upheld as far as the facts were concerned but did not decide as to his jurisdiction, virtually disallowing Rochester's appeal.

Decided by Court of Appeal, 1895.

The municipal law requires considerable modelling to meet the ever-changing necessities, but frequently attempts to better it have proved the reverse, yet there is one case in which, in our opinion, a change is necessary and desirable. More particularly is this the case in this part of Ontario where drainage assessments form one of the principal burdens of the farmer. No one is secure from such an assessment and any legislation that can lighten the burden ought to meet the approval of a majority of the legislature, which is composed very largely of farmers or men interested in farming lands. We have now a direct case in point. Some time ago parties who live near the mouth of Sturgeon Creek, applied for relief to the municipal council of Mersea, claiming that their lands were flooded by waters brought down the creek and that they would hold the council responsible unless relief was granted. The lands in dispute are about 35 acres, which are liable to be flooded at any time that a freshet occurs. The council, it appears, has no option in the matter if the petition and demand is in accord with the statute. In accordance with the appeal, they appointed an engineer to examine into the matter and make a report. This was done, the report accepted, and the engineer instructed to make an assessment, which he did, no doubt to the best of his ability, and in doing so, assessed the Township of Gosfield $136 for injuring liability. That township appealed and the case came before His Lordship Justice Britton who, after hearing all the evidence, reserved decision. The cost of repairing the drain or enlarging it, so as to prevent the flooding complained of, was about $1,000 and the costs of reference will be in the neighborhood of $500 or about $43 an acre for the lands occasionally submerged. The same trouble is likely to occur again and again, and under the present law there is no redress. The municipality must make the survey and assessment. Were the law so amended that the municipality interested could acquire such land by right of purchase, assessing parties for payment who would be liable were a drain constructed, it would settle the matter for all time, and prevent any demands being made for damages. United action should be taken by the municipalities in Kent and Essex and strong appeals be presented to the Government for redress.—*Leamington Post, February 14th, 1895.*

DISCUSSION.

Mr. Gibson—I had a case last fall in which the party through whose land the ditch would be made (where there was no ditch before) objected to the whole proceeding, on the ground that there was no provision made apparently under the Ditches and Watercourses Act for being recouped for the damage that the ditch would do, and asserted that if I went on and made my award, as is generally done under the Ditches and Watercourses Act, he would enter an action for damages—that it would undoubtedly be a damage to the land. Now, the question is this: Under the Drainage Act of 1894 there is an injuring liability and outlet liability and benefit liability, but under our Ditches and Watercourses Act there is no provision made apparently for a person being recouped for any injury that may be done him over and above the benefit. I have a case in the Township of Vaughan where the party claims that if I go on and make my award that it will be a very great damage to him Now, does the Ditches and Watercourses Act provide for injury, or is it necessary to appeal to the courts on common law principles for damages? Of course, at the same time I advised the parties that I would make my award in such a way as to do as little damage as possible, and that afterwards, when they got over their temper, they could probably dig the ditch and nobody would say anything about it.

The President—I have learnt that there is a good deal of difficulty in the interpretation of Sub-sec. 5 of Sec. 3 of the Drainage Act in the construction of drainage work. "The assessment for injuring liability and outlet liability provided for in the two next preceding sub-sections shall be based upon the volume, and shall also have regard to the speed of the water artificially caused to flow upon the injured lands or into the drainage work from the lands and roads liable for such assessments." That question, I believe, has been up two or three times before the Drainage Commissioner, and there has not yet been an engineer who has been able to answer it What does it mean ? An expression of opinion from this Association would be a help to the members who have to work at it, and would without doubt assist the Drainage Commissioner very often in coming to a decision. Does that mean that the engineer is to take that water in flood time and calculate its velocity, or in the normal flow of the channel, or under what conditions ?

Mr. Gibson—He would have to consider the difference in the volume before the ditch was made and after.

Mr. Bowman—You may remember, gentlemen, that our Drainage Report last year touched on this point, adjusting between " injuring liability " and " outlet liability," and our recommendation was that that method of assessment be left optional with the engineer. From what we could tell at the last meeting, very few drainage engineers understood what was meant, and it seems to me that we are not called upon to advise the Drainage Referee how to carry out this Act. They enacted against our wishes, and if they have got into a muddle they had better get out, or repeal it and leave it optional, as we suggested.

The President—If it is something that is unworkable, let us point it out.

Mr. Gibson—What right have they to refer in the Act to the volume of water ? They should just let it alone.

The President—Who put that there ?

Mr. Ross—The Drainage Commission.

Mr. Gibson—That is hampering the engineer ; they should not have put it in at all. He should be allowed to judge between " injuring liability " and " outlet liability."

The President—Would it not be advisable for the Drainage Committee to formulate an explanation, showing that this on the face of it is something that is ambiguous and absurd, and lay it before the Commissioner of Crown Lands and ask him to have it remedied ?

Mr. Ross—The opinion of the Drainage Committee was that we had better not ask or suggest any changes just now ; that probably we would understand this Act a little better in a few years We did not know exactly what some of it meant, and some of these cases I have referred to in my report may be decided, so we thought it better to make no suggestions at present. In the discussion last year there was not a member here who could say why " injuring liability " should be different from " outlet liability," and we recommended that " outlet liability " would cover the whole case. When drainage work is constructed I don't think any lands should be injured. It should be constructed large enough so that no lands would be injured, and I think that is the intention of the Act. That case I read from Mersea covers " injuring liability " very clearly. Of course, it is the lands that are assessed for outlet that pour water down on these lands that are assessed for "injuring liability," but it is practically the same as "outlet liability" as far as I can see.

Mr. Gibson—For instance, in making half a mile or a mile of a ditch you make a large cut that separates one portion of a man's land from another; that is a direct damage or injury to that land, and he might appeal to the court as a matter of common law for redress.

Mr. Ross—Under the Drainage Act, you can provide for such things, construction of bridges and the disposal of the material excavated

Mr. Gibson—That is provided for under "outlet" and under the ditch itself, but my land might be damaged materially by putting a wide, deep ditch through it, and I say that is injury.

Mr. Ross—That does not come under "injuring liability."

Mr. Gibson—But I say it is common sense. If the ditch does me a damage I ought to be recouped for it. It should be put in that way.

Mr. Robertson—I think amongst surveyors up west it is very much as it is in other places: there is considerable difference of opinion with regard to assessing for "injuring liability" and "outlet liability." At the same time probably there is some reason for assessing for both and having them assessed separately. I think the intention of the persons who constructed the Act is this, that when you can describe an area that is injured by water being carried down by the construction of drains in higher land then you would assess for "injuring liability." For "outlet liability" you can go up stream on a natural water course for the construction of a ditch that carries water in that direction, as far as you like, even although there may be a certain amount of land along each side of that water course that might be injured more or less. I think the assessment would not come under the head of "injuring liability"; that would be "outlet liability" right to the head of the drain, with the exception of what you would assess for benefit. With regard to the section referring to the volume and flow of water, I think the intention is this: that if there is one water course that carries water from higher land into the drain you are constructing and assessing for with greater rapidity than another one that might come in in another direction through lower land with less velocity, the water that comes from the higher area will get down into the lower land in a greater volume in the same time than the same area draining in from another direction with smaller fall. In that case they should probably pay more.

Mr. Bowman—Have there been any cases under the new Act yet before the Referee?

Mr Robertson—Yes, there are several cases. There was a case in the Township of Sarnia and Township of Plympton. The Township of Sarnia constructed a drain, some 27 or 28 feet fall, to the town line, and I think one of the grounds of appeal was that the Township of Plympton should have been assessed for "injuring liability," while they were only assessed for "outlet liability." The Referee held that "outlet liability" was all right, and it was not necessary to assess them for "injuring liability."

Mr. Ross—Was the decision of the Referee that "outlet liability" covered both ?

Mr. Robertson—No, but that it was only necessary to assess the lands under the head of "outlet liability." There was no assessment for "injuring liability."

Mr. Ross—I think myself that is the easiest way to get out of it, and I think your definition there is probably the right one That is the only way I can see it myself; but, of course, all the waters that come down from higher lands above would tend to injure the lower lands as well as water that comes down quickly from adjacent lands. Suppose you had a large area of marsh and 1,000 acres, say, bordering that marsh. There is, say, half a mile where the slope is pretty rapid, perhaps 15 or 20 feet in half a mile, and then up above that there is a gradual rise, would you assess the lands on this slope for "injuring liability" and the upper lands for "outlet liability."

Mr. Robertson—No ; I would certainly assess them for both in that case. In my opinion the assessment should certainly be both for "injuring liability" and "outlet liability" where there was a lower level that was injured by it ; that is, a defined area that could be described.

Mr. Ross—And this marsh would all be assessed for benefit ?

Mr. Robertson—Yes ; you would, of course, try to define your limit of benefit. As I understand it, drains are constructed from this higher land to the marsh, thus injuring it. It is necessary for the improvement of this marsh land, or land that is injured, to relieve it from the injury and to improve it ; it is necessary to construct a drain The construction of that drain will benefit this low land ; assess this low land for benefit and outlet. Up here we come to where there is no benefit by the construction of that drain, but still those lands pour their water down on this land. Then, what I maintain is this: that all this area should be assessed under two heads, for "outlet" and "injuring liability."

Mr. Aylsworth—What do you call "injuring liability" ?

Mr. Robertson—For relieving this place of the water that they pour upon it ; they have a right to help to carry it off.

The President—The only question is how to distinguish the "outlet" from "injuring liability."

Mr. Robertson—That is a matter of judgment.

Mr. Ross—You take a case, an acre of land in that marsh and assess it so much for benefit, say $5 ; how much would you assess it for outlet ?

Mr. Robertson—Well, the "outlet liability" is generally in proportion to the distance the water has to be carried through the drainage work, and cost of that.

Mr. Ross—In that case there is a main drain made across that marsh to the upper side of it.

Mr. Robertson—It is a pretty difficult matter to put it in figures.

Mr. Ross—In what relative proportion would you make that assessment for "injury" and for "outlet."

Mr. Robertson—Well, of course, the proportion for benefit would have to be determined entirely upon the amount of benefit that was going to be received; and then all the land probably should not be assessed very differently from the same rate per acre if it is all using the same length of outlet.

Mr. Aylsworth—Supposing that upper plateau had not been drained at all—they just depended on the furrows in plowing and it naturally drained itself; could you then assess for "injuring liability"?

Mr. Robertson—I think probably then it would hardly be right to assess for "injuring liability."

Mr. Gibson—If the upper lands join in the petition for it, then they are in for it.

Mr. Ross—Here is another case from Mr. Baird: "At the reference it seemed to be difficult to draw the line between 'injuring liability' and 'outlet liability,' in which, in fact, I cannot see very clearly where the line could be drawn. It also seemed to be held that when a man was assessed for benefit that it should be equal to the value of the land when placed in a state of cultivation, which to me seems erroneous, and should only be to the extent that it would cost these lands to construct a sufficient drain." Can you explain that?

Mr. Robertson—My opinion is this: Supposing these upper lands were in a state of nature; if these lower people wanted to drain their lands, they should construct and pay for a sufficient drain themselves. But as soon as those people begin to pour their water down by artificial drainage, changing it from a state of nature, I think that they should contribute.

REPORT OF COMMITTEE ON TOPOGRAPHICAL SURVEYING.

Mr. President,—Owing to the fact that the members of this Committe reside at such widely separated points, it was found impossible to secure a quorum for the transaction of business, except on the first day of this Annual Meeting.

An informal meeting of surveyors interested in this work was held, on the invitation of the Chairman, in Toronto on December 31st, 1894, to discuss the preliminary steps of procedure, at which the following surveyors were present :—

W. F. King, D.T.S., Chief Astronomer, Department of the Interior, Ottawa.
G. B. Kirkpatrick, O.L.S., Director Crown Land Surveys (Ontario), Toronto.
John Galbraith, M.A., Professor Engineering School of Practical Science, Toronto.
L. B. Stewart, O.L.S., Professor Surveying School of Practical Science, Toronto.
A. J. VanNostrand, O.L.S., Secretary Association O.L.S., Toronto.
V. Sankey, O.L.S., President of Council O.L.S., Toronto.
F. L. Foster, O.L.S. (of Unwin, Foster, Murphy & Esten), Toronto.

At this meeting, after several hours of earnest discussion, it was decided to ask each member of the Committee to communicate with some country where geodetic and topographic surveys have been made, and ascertain officially the *commercial* advantages that may be expected to follow, especially pointing out the benefit the agriculturist will reap therefrom.

On January 10th, 1895, a circular letter was sent out by the Chairman advising each member of the informal meeting and the conclusion arrived at, and each was requested to communicate with the country set opposite his name, as follows :—

Casgrain, J. P. B.	Montreal	France
Cozens, Jos.	Sault Ste. Marie	U.S. Lake Survey
Chipman, Willis	Toronto	U.S. Coast and Geodetic Surveys
Dickson, Jas	Fenelon Falls	Great Britain (Scotland)
Fawcett, Thomas	Ottawa	Sweden and Norway
Klotz, Otto J.	"	Germany
Ogilvie, William	(absent in Alaska)	
Russell, A. L.	Port Arthur	Spain and Portugal
Sankey, Villiers	Toronto	Great Britain (England and Ireland)
Stewart, Elihu	Collingwood	Russia
Tyrrell, J. W.	Hamilton	Austria

With few exceptions the members assumed the responsibility of seeking the information asked for, but to date replies have been received from the United States only. No doubt, full replies will be received from all shortly.

Your Committee recommends that the Association empower it to consult with the Ontario Government when convenient respecting the action to be taken after the data is received from foreign countries.

WILLIS CHIPMAN,
Chairman.

DISCUSSION.

Mr. Bowman—It seems to be recommended that the Committee immediately upon receiving this information interview the Government. It seems to me that would be a little premature; it would be better if the information were laid before the Association and the members thus informed as to the great advantages to be derived from a topographical survey, so that when the representatives begin to inquire throughout the province we will have a united opinion upon the matter.

The President—It seems to be pretty well settled amongst surveyors that they will unite. The thing is not to postpone it too long ; it takes years to get the slightest movement in these cases.

Mr. Gibson—I think they have gone about this matter in a very excellent way, getting the data that is required. The Government wants facts before they take it up at all.

Mr. Dickson—I think the intention is to get all the data they can and then get together and formulate a report, and at some convenient season interview the Government. I don't think there is a single individual member of this Association but will heartily endorse the scheme, and if it is a feasible scheme it should be carried out. I think it should be adopted in Canada with the least possible delay

Mr. Sankey—I would suggest that Mr. Chipman just give a short outline of the probable benefits to be derived from it In that way I think the objection taken by Mr. Bownan, which I think is a good one, that the members of the Association should have as much knowledge regarding it as possible, could be met and the ground covered sufficiently at present.

Mr. Chipman—I might say, Mr. President, that the question of cost is well understood by all engineers and surveyors. It would depend upon the accuracy of the work and the amount of detail work done The first thing to be done of course is the primary triangulation work, and it appears to be the opinion of the Committee that this work can be best done by the Dominion Government, and possibly the secondary triangles, but that the topographical work, all the detail work, must be done by the Provincial Government and by the municipalities. In the circular sent to the members, requesting them to communicate with the different foreign countries, it was specially stated that we did not wish any information respecting the cost or the benefits to be derived from a military standpoint or the advantages to be derived by navigation. We all know that it is patent to any one that this is not a military country, it is an agricultural country chiefly. The reply I have received from the United States Coast Geodetic Survey may be of some interest to you. (Reads letter in reply to letter of January 15th.)

I regret to say that is the only communication we have received, as stated in the report, but I have not the least doubt but that others will be received very shortly.

As to the remarks made by Mr. Bowman, the Committee concluded that it would be better to take the Government into our confidence at once. We believe that the members of the Government may require considerable enlightening on this subject, and it will take at least one year to enlighten them even up to our present plane of knowledge on this matter. It will take some time, but I believe if we once get them interested in it that we will have no difficulty in getting the work started. The primary triangulation of course must be done first, and if the Ontario Government would urge the necessity of it upon the Dominion Government it would probably be commenced, but we cannot ask the Ontario Government to go on with any work until the primary triangulation work has been commenced, that is out of the question. We, therefore, decided to first interest the Ontario Government in the proposed work. We must not forget that the Commissioner of Crown Lands is one of the officers of our Association, and I think he should be consulted in this matter.

Mr. Dickson—I do not anticipate that when we go to the Government to ask them to do this that they will do it. It will take some time to work it up, and every member of the Association, and I think farmers as well, might be interested in its behalf. I think we might naturally expect even the Patrons to fall in with it. But I think it will be some time before we get either Government sufficiently interested to say that they will do it, so that we have got to keep at it until we get some substantial progress made.

Mr. Bowman—The explanation given by Mr. Chipman, I think covers what was wanting, and that is that the Ontario Government is not at present asked to make any outlay, only to communicate with the Dominion Government in regard to the advisability of commencing the primary triangles, and I think we can trust to the Dominion Land Surveyors at Ottawa to supply the necessary information there.

Mr. Aylsworth—I think that this survey is going to be a grand thing, even for the farmers themselves, and I think they are the ones we might start with first and educate them. If I understand this topographical survey scheme, it is a large topographical plan just the same as you get up for a sewer system in a city, shows the grades of streets, heights, etc., and it is going to show the water courses and all the depressions and elevations.

Mr. King—It seems to me that the main thing is to get in the information that Mr. Chipman has mentioned, and the Committee is already acting in that line to get information from all countries that have made such surveys as to what actual commercial benefits, etc., might be received from it. If you can get strong evidence in that line it would greatly strengthen the case in this country. As to the cost of triangulation or topographical survey, of course it all depends upon how much detail you put in. I believe a good survey can be made for $20 to $30 per square mile, that will be sufficient for general purposes in this country; including plans and everything. I know you can spend a great deal more money on it if you please. The United States Coast Survey made a very full and complete survey of the part of the District of Columbia around the City of Washington which cost $1,500 a square mile. That goes down to very minute, detail, though; gives contour lines of four or five feet. They made a little model of it and exhibited it at the World's Fair, and it gives a bird's eye view, as it were, of the district. That cost is of course apart from the cost of primary triangulation. In most surveys there are three triangulations, the primary triangulation which covers sides of thirty or forty miles long perhaps. Those are done with the greatest accuracy. Then the secondary triangulation, which divides the area into smaller triangles of six to ten mile sides, and then the tertiary triangulation, which is a part of the topographical work, but the cost of that is included. When we say that topographical work costs so much per mile, that includes the primary and tertiary triangulation. The greater part of Ontario being flat, the sides of the primary triangles would be short, ten or twelve miles, and the topographical triangulation would be tied on them so that the survey would not be as expensive as the usual topographical and geodetic survey.

REPORT OF THE LAND SURVEYING COMMITTEE.

Your Committee beg to report as follows :—

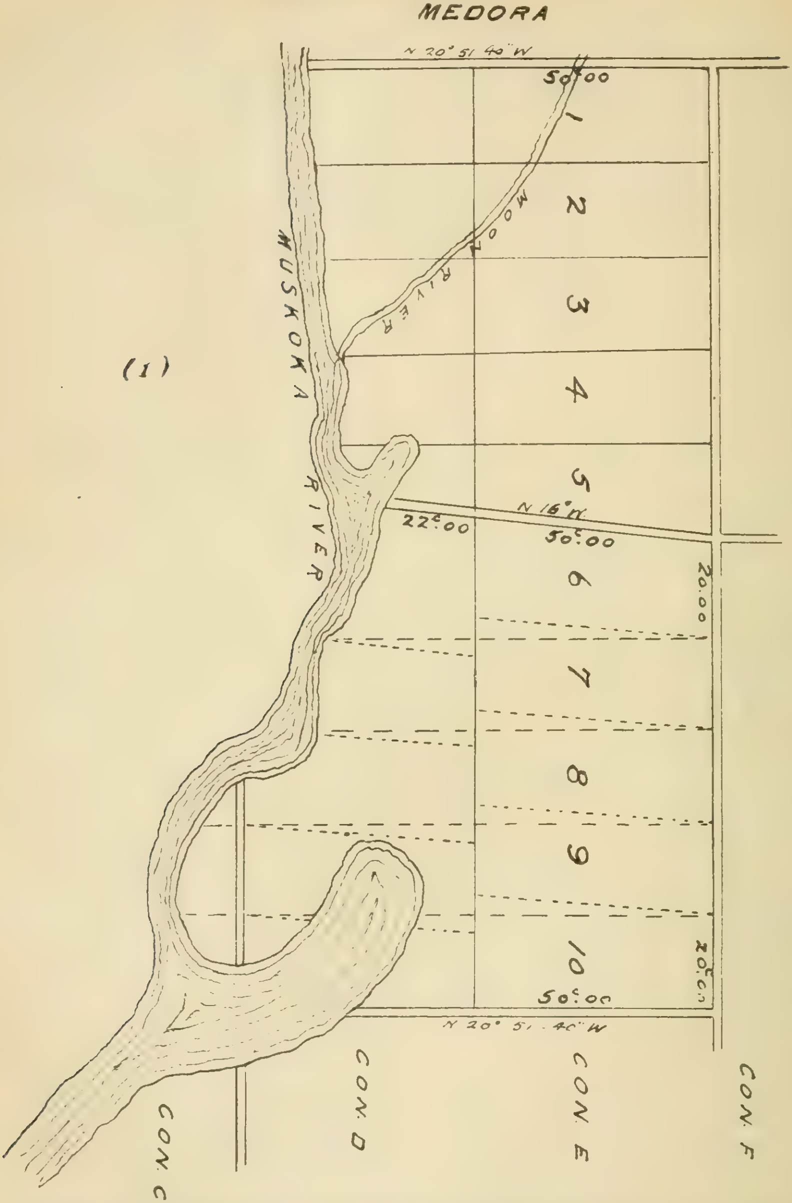
Several questions on surveying have been sent to your Committee, which questions and the answers to them are annexed hereto. We would suggest that members in submitting questions as to surveys in townships would state the name of township, as this would enable us to examine instructions, plans and field notes under which such surveys were made, and would assist us very materially in arriving at correct solutions. It is to be regretted that more of our members do not take advantage of the "Question Drawer" as a means of throwing light upon the many knotty problems met with in practice. An expression of opinion or interchange of ideas must be beneficial to all concerned.

Your Committee would be glad to receive any court decisions of importance met with during the year; also any suggested amendments or additions to the "Survey Act" of 1887, so that they may be laid before our Association at the next annual meeting, and be ready, if necessary, for the next revision of the Ontario Statutes.

All of which is respectfully submitted.

T. B. Speight,
Chairman.

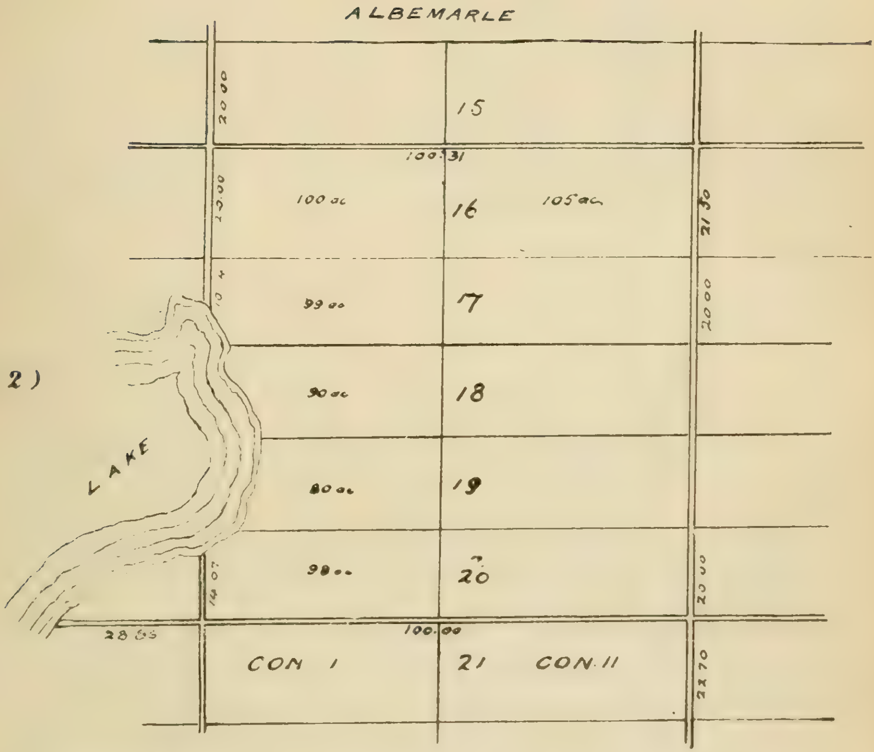
QUESTION DRAWER.



Question 1.—On which course should side lines of lots 6 to 10 be run?

Original plan shows bearings of all side lines to be N. 20° 51′ 40′ W. Asty. Bearing of side line 5 and 6 as run in original survey is N. 16° W. Ast. This side road is plainly marked on the ground. The river is the south boundary of the township.

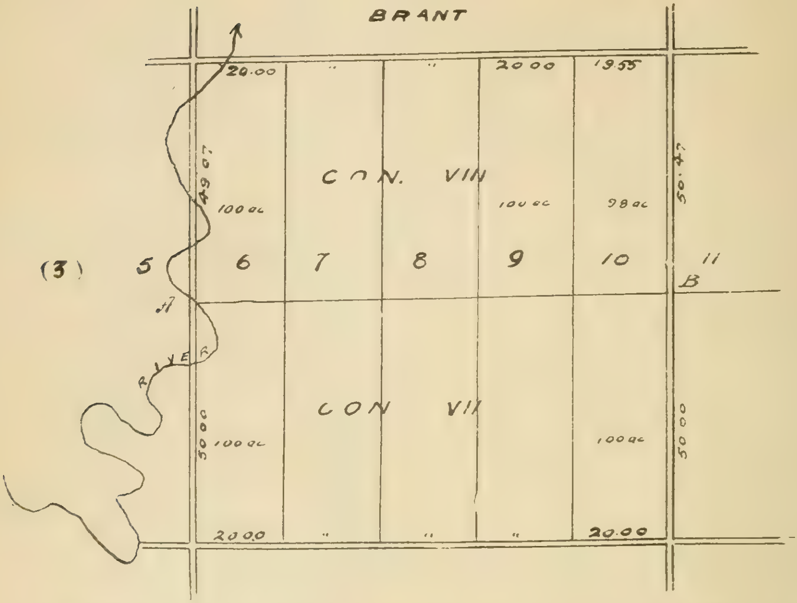
Answer.—On same course as line between Lots 5 and 6.—(Sec. 59).



(2)

Question 2.—In that block, including lots 16 to 20, Cons. I. and II., East Bury Road, there is a part of a lake on the fronts of lots 17, 18, 19 and 20, Con. I., as shown on the sketch. How would you run the lines between these lots, as there were no posts planted at the fronts, being in the lake?

Answer.—Divide widths of broken fronted lots proportionately by measuring along blind line.—(Sec. 54).

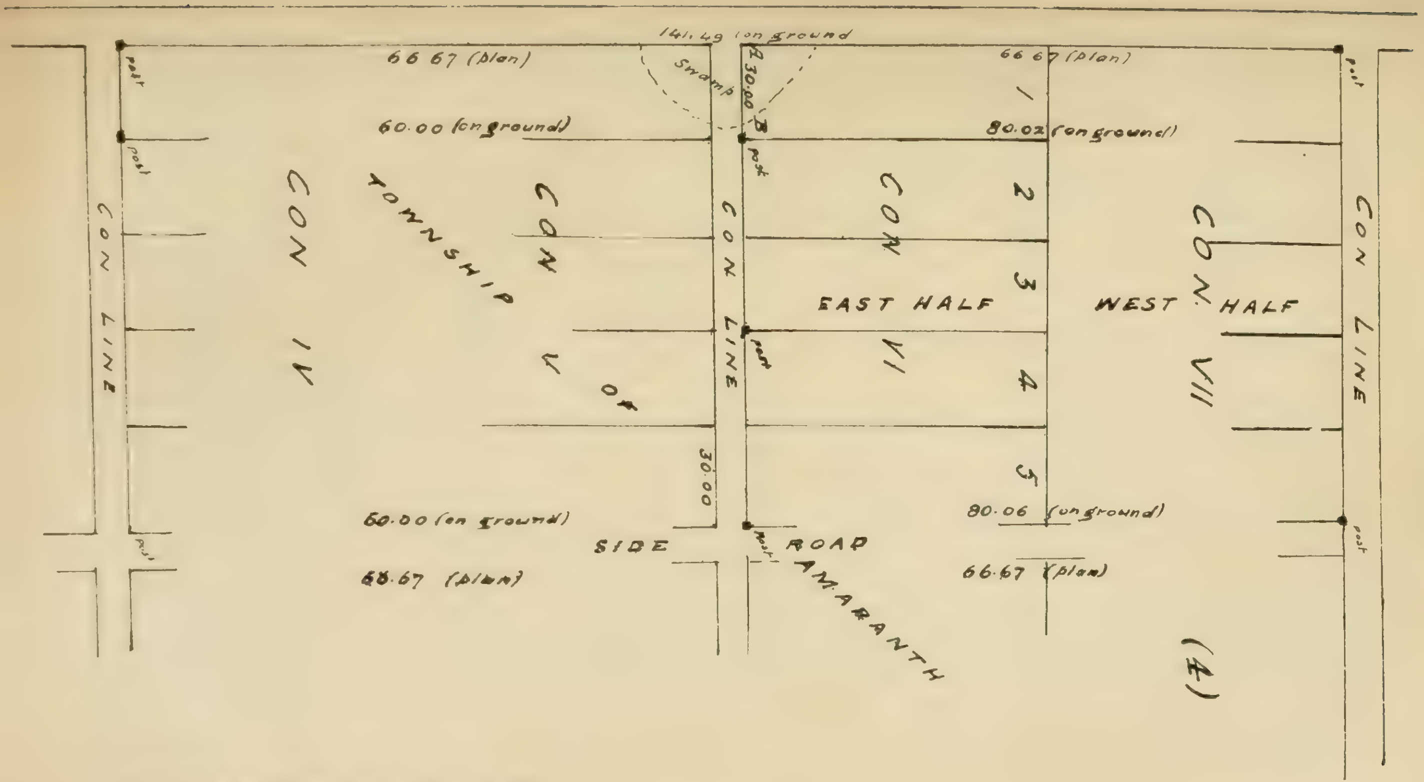


Question 3.—In the block including lots 5 to 10, Cons. VII. and VIII., the post at A is lost, but the field notes give the distance across Con. VII. as 50c. and Con. VIII. as 49c. 07l. on the side road, lots 5 and 6; and on the side road at lot 10, Con. VII., is 50c., and Con. VIII. 50.47. There is a post at B. All the lots except 10, Con. VIII., are deeded as 100 acres. How would you run the blind line in this block? or across lots 5, 6, 7, 8, 9? The concession lines are parallel, though the field notes show different widths.

Copy of part of instructions to A. P. Brough, P.L S., 7th of May, 1850, to survey part of the Township of Brant: "You will proceed to subdivide the residue of the Township of Brant into farm lots of 100 acres each, in conformity with the accompanying projected plan, tracing all concession and side road lines in the centre of the road allowances, which are to be one chain in width, and planting the posts, duly inscribed with a marking-iron, at the distance of 50 lks. from your lines. The lots are to be 20 chs in breadth by 50 in depth, with road allowances between each alternate concession and every fifth lot."

Original field-notes show blind line posts.

Answer.—For theoretical depths of Lots in Con. VIII, proportion plan depths on side roads. Use depths thus obtained in proportioning for blind line. (See Sec. 57 Survey Act; also pages 96 and 97 of 1888 Report Association, P. L. S.). Accept post at B, if evidence satisfactory.

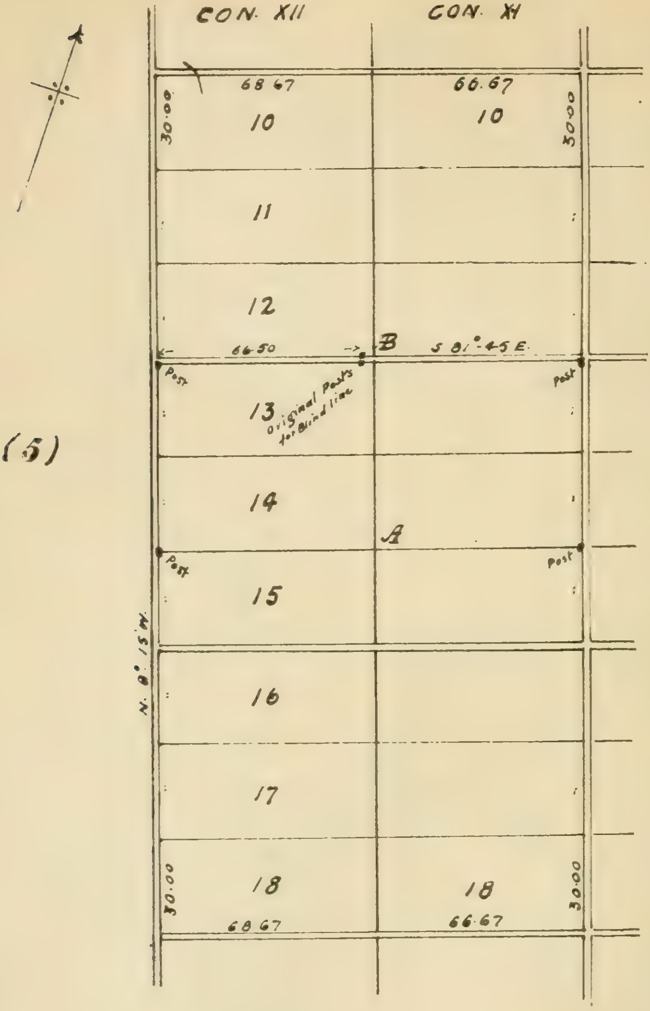


Question 4.—How to establish A B?

Concession line between V. and VI. has been opened and travelled on for the last fifteen years, statute labor being done on same during that period. Nothing on ground from A to B to fix line. Township surveyed in 1822.

Answer.—Fix point at A by dividing the four concessions proportionately between undisputed corners.—(See Sec. 60). Join A and B.

(5)

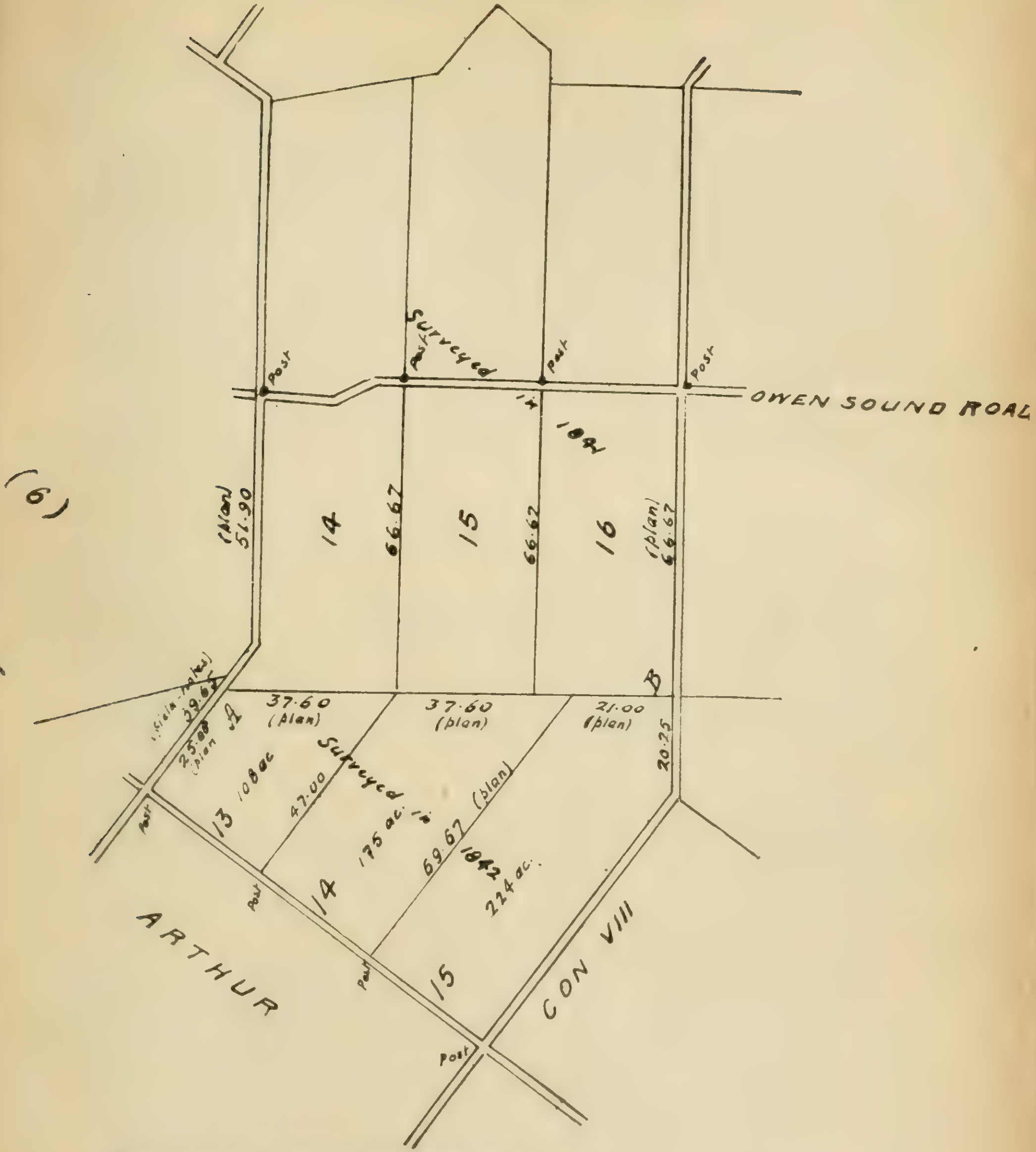


ARTHUR

Question 5.—How to establish blind line A B?

Side roads run originally parallel to north boundary, and lots number from same place. Every second side road run. Concession lines parallel to east boundary of township. In instructions surveyor was not told to plant blind line posts. In report or field notes there is no mention of said posts. Surveyed in 1842 by John McDonald.

Answer.—Disregarded blind line posts as not planted under authority.—(See Sec. 41).



Question 6.—How to establish A B?

Portion to west of A B surveyed in 1842; portion to east of A B surveyed in 1841, by John McDonald, P.L.S. Roads *colored* as laid out originally. In the instructions he was told to make his survey of 1842 fit with that of 1841.

Answer.—Proportion to fix points at A and B.—(See Sec. 57). No statute to cover the intermediate lot corners. For equitable survey join A B.

Question.2.

Mr. Dickson—I think the law is clear upon it.

Mr. Kirkpatrick—Under the old Act the clauses were so indefinite that when the Act of 1887 was brought in we had a good deal of manœuvering to find the word that would exactly suit. Some would say, just measure it out across, or some were inclined to get into the next concession, but you see there is no clause in the Act to go into the next concession, and it was often found in practice that if you ran from the second concession through--in one case there was a difference of 5 or 10 chains of a jog, and it was going to make quite an insurrection in that particular concession, and it was thought that that was the best way because it was the closest approach to what was intended in the original survey.

Mr. Dickson—I think it is well because it does away with any ambiguity that might arise.

Question 3.

Mr. Gaviller—You would divide it proportionally ?

Mr. Speight—Yes.

Mr. Aylsworth—How do you divide it at A ?

Mr. Speight—Divide it proportionally.

Mr. Sankey—In other words, the field notes as returned govern.

Mr. Aylsworth—Would you divide up for the blind line between lots 10 in concessions 7 and 8 ?

Mr. Speight--Certainly.

Mr. Gaviller—Take between 8 and 9, how would that be divided ?

Mr. Niven—Take the mean of 49.07 and 50.55, that will give the depth at 8 and 9.

Mr. Bowman—It would not do to take the mean.

Mr. Sankey—Well, take the proportion.

Mr. Johnston—How about the original blind line post ?

Mr. Gaviller—In this case I understood Mr. Speight to say that that original stake is not only on the ground but in the field notes in the Department.

Mr. Johnston—Sometimes you will find the stakes on the ground and not shown in the field notes.

Mr. Gaviller—I think in that case they are repudiated by the Crown Lands Department. I have known a case where a surveyor actually posted the line between the concessions and the posts were there to be found.

Mr. Dickson—Taking surveys like this the surveyors are especially instructed not to post the blind line.

Mr. Gaviller—That gives trouble, they put in posts when there were no instructions.

Mr. Chipman—Now as to the line from A to B.

Mr. Sankey—Isn't it possible from that drawing, to put the proportion on between 9 and 10, whatever it comes out; then you measure up on the ground between 9 and 10 in both concessions and divide proportionally.

Mr. Bowman—But that point is fixed by the stake B, and these measurements while shown there really don't govern as I understood.

Mr. Sankey—They don't govern on the line itself but they certainly govern the rest of the block.

Mr. Gibson—What is the length the line between 9 and 10 was intended to be in the original survey in the 8th concession?

Mr. Speight—As a matter of fact it does not show it.

Mr. Gibson—What were the instructions?

Mr. Speight—50 chains.

Mr. Gibson—Then if you want to find the line between lots 9 and 10 the Statute says you must give the proportion of that intended in the original survey. They were intended to be equal. Chain through then and take half and plant your stake. If you do the way you are proposing you might as well draw a straight line across between them. The law requires you to divide the concessions proportionally to what they were intended.

Mr. Speight—But if they were returned to the Department differently and accepted by the Department? That was shown on the original survey as 50.47.

Mr. Aylsworth—How would you divide up between 5 and 6, Mr. Gibson?

Mr. Gibson—I would chain through and give the north concession the proportion of the depth to what is shown in the original notes. It was intended to be 50 chains, but the notes show what they are on the ground exactly.

Mr. Gaviller—But Mr. Gibson has before stated what has been the rule of the Committee in former years, that is that they should be divided proportionally as intended in the original survey, half and half, and skewed in to the other point.

Mr. Sankey—You are making a difference between the original survey and instructions; it is correct according to the instructions but not according to the original survey.

Mr. Speight—When the Returns are accepted by the Department they are *ipso facto* in accordance with the instructions.

A Member—My impression at first was that it should be divided up proportionally, in the way you speak of; but I believe now, after hearing the matter discussed, that where we find the field notes and on the plan, as in the case at A, 50 and 49.07, then we should divide in accordance with those figures, but where there are no figures on the plan as between 6 and 7 and the other lots, the instructions say that they are 50 chains, and it seems to me that we should divide on that basis.

Mr. Jones—Do you know what the chainage was on the ground for the east limit of lot 10?

Mr. Speight—I don't know what that was.

Mr. Jones—Because the question would come up again, while the instructions might have been 50 chains each the original survey might have been returned as 50.47, and then the question might come up, when it was chained on the ground it might be only 50 chains or 49½.

Mr. Chipman—What is the actual chainage from B to that concession line?

Mr. Speight—These figures are taken from the plan returned by the surveyor. On the ground the stake at B is midway between he fronts of concession 7 and 8. He says both sides are parallel.

Mr Aylesworth—I think that between 5 and 6 ought to be divided up in the proportion between 50 and 49.07.

Mr. Jones—He may mean by saying they are parallel that they are simply returned with the same bearings and intended to be parallel.

Mr. Sankey—You can't discard the post at B no matter where it is.

Mr. Gibson—Is that a double front concession?

Mr. Chipman—I understand that Mr. Gibson would run the line between 8 and 9, and make the line in the 7th concession the same length exactly as the one in the 8th when the original field notes show that the lines in the one concession are not the same as the other.

Mr. Miles—I ran a blind line like that in the County of Bruce and I made the length of the lots 7, 8 and 9 all equal.

Mr. Sankey—What is the proportion in depth intended in the original survey?

Mr. Gibson—If you take up the patents you will find it is 50 chains.

Mr. Gaviller—The question is, do the plan and field notes on record over-ride the instructions? I think there is no doubt about it. The surveyor was not instructed in the first place to make these broken distances.

Mr. Gibson—In the first place the instructions are that in laying out a section like this no blind line stakes should be planted at all, but they were planted by surveyors; I know when I was a boy we put down mere pickets. And in this case the surveyor is expected to go back and he divides up the proportion. The point B stays where it is because it is the original boundary passed by the Crown Lands.

Mr. Sankey—On the same principle you have got to adopt what the Crown Lands adopted in receiving that plan with various widths; one governs as much as the other.

Mr. Gibson—If you look up the patents you will find they are 50 chains each.

Mr. Speight—Suppose these lots are all shown 20 chains in breadth, except lot 10, 20.50 chains, how would you do?

Mr. Gibson—I would give that lot the proportion of the whole breadth; if there was a surplus on it I would give it a greater width, and the others proportionally.

Mr. Kirkpatrick—Supposing you are asked to describe this without going on the ground at all; you take that block or section and there are the distances. Now you are asked to supply distances. Could you commence at the north-west angle, we will say, on No. 6, thence due east 20 chains, thence due south 50 chains, thence due west 20 chains to the sideroad, thence due north 49.07 chains? Is that the way you would describe that? Would you not calculate it in proportion? Take that 49 07 and 50.47 and supply on the paper on each sideline there the calculated distance. If you plotted that, it could not be 50 chains and a straight line because there is 49.07 at one end and 50.47 at the other. Now enlarge that to a very large scale and it won't be 50 between 6 and 7. I think you would put on the proportion as it is on the plan and field notes, then go on the ground and lay off the depths in that proportion.

Mr. Gibson—How do you know the concession lines are straight?

Mr. Kirkpatrick—I am saying without going on the ground at all. You are writing a description from the data that is there; would you make 50 chains there?

Mr. H. H. Gibson—There are none shown on the plan: why not just describe it without the dimensions at all, just describe it due south to the rear of that lot?

Mr. Chipman—I think if I were a surveyor and called upon to give a description I would begin at the north-west angle, thence along the front of the lot, then south to the rear of the lot so many chains more or less.

Mr. Sankey—By not giving distances you are just putting off the evil day.

Mr. Davis—What we want to know is how to run between 8 and 9?

Mr. Sankey—Is there any difficulty at all in calculating from the plan in the Crown Lands Department the lengths of the sidelines in concession 8? Is there any difficulty in getting the proportion of the length of each sideline between the east of 6 and the west of 10, as shown on the plan on record in the Department?

Mr. Davis—No.

Mr. Sankey—I would submit that the first thing a surveyor would have to do would be to supply these distances on the plan, then go on the ground and measure through on the sideline across 7 and across 8 and divide the distances you find on the ground in the same proportion as that plan gives. You are doing it equitably ; you are doing it as it was intended in the original survey and making all allowance for incorrectness in the lines between 7 and 8. It may not be correct, but you are giving the man the proper proportion he is entitled to.

Mr. Gibson—I have been speaking of the patent, what the intention was.

Mr. Kirkpatrick—You are giving one man 50 chains and giving him his 100 acres and you are not giving the other man his.

Mr. Gibson—If that is a double-fronted concession you would have to divide it on the principle of half and half anyway ; then you would take half the depth.

Mr. Davis—I see no reason why we should take the measurements at the east side of 10. It strikes me we must deal with that line by itself. If no distances are given in the plan or field notes, then we must take those that should have been there, or intended to be there. It is a question that comes up in nearly every surveyor's practice several times a year ; it is one of the most common occurrences in surveying. The way I have been doing it is this : I have chained through on the line between 8 and 9 without any reference to the other ends of the lot. That concession line might be crooked ; both of them might be crooked.

Mr. Sankey—Does not the Act say you shall divide them equally if so intended, and if not, then the proportion as intended. Does not that show that it was not intended, and was not in fact equal ?

Mr. Davis—No, it does not. That plan merely shows that the line between 10 and 11 is not equal ; that plan shows that the line between 8 and 9 is equal in the 7th and 8th concessions.

Mr. H. H. Gibson—The plan shows it was never a complete survey ; it is only just an outline survey.

A Member—I have a survey down in Ontario where I was instructed to put in these posts in that blind line, and I put them in under instructions.

Mr. Gaviller—Was that a re-survey ?

A Member—No, an original survey.

Mr. Gaviller—I think the Act has some extra wording in it so as to endeavor to make it plain. It says—" That is to the centre of the space contained between such alternate concession lines, if the concessions were intended in the original survey to be of an equal depth, or if they were not so intended, then to the proportionate depth intended in the original survey, as shown on the plan and field notes." Now the intention there would be the instructions issued to the surveyor, not what his field notes showed at all. I don't think you can go outside of the instructions as far as intention is concerned. Then whatever these field notes show, the way we have ruled before is that that simply had reference to the side of the lot next the sideroad, and then divide according to instructions, that is the intention, and that is to the centre of the block for the interior lots. Chain it through and divide it equally, that is, between 6 and 7, 7 and 8, 8 and 9.

Mr. Sankey—How about between 5 and 6 ?

Mr. Gaviller—That is actually on record.

Mr. Dickson—I understood that he was instructed to plant that concession post.

Mr. Speight—No, there were no instructions given.

Mr. Dickson—Well, I would discard it altogether.

Mr. Gaviller—It is shown in the field notes.

Mr. Dickson—It is just one of these things that could be very easily overlooked, and I would discard it altogether if I found that he was instructed not to plant these posts.

Mr. Gibson—I would require an awful lot of swearing to prove that that stake was the correct one. I would not believe that was the stake unless I found the distances correspond exactly with it.

Mr. Dickson—Do the deeds show equal area ?

Mr. Gaviller—They are described as 200 acres.

Mr. Dickson—I assume that all the lots are 20 chains wide, east to west. On the plan do they all show it ?

Mr. Speight—Yes, they are all deeded 100 acres.

Mr. Chipman—How many here present would run the line between 8 and 9 and then divide equally between the two concession lines, or how many would do it in some other way ?

Mr. Gaviller—Suppose we confine it to the question of how the line between 8 and 9 shall be defined.

Mr. Dickson—I will move that the blind line at the point between 8 and 9 in the 7th and 8 and 9 in the 8th concession be located by ascertaining the distance between the two concession lines on the ground, and then dividing that equally.

Mr. Jones—I will second that.

Mr. Niven—I cannot vote on that motion until I know whether the surveyor was instructed to plant posts at B and A.

Mr. Speight—I have read the instructions and there is no mention in the instructions about planting a post any place in the whole township. (Reads instructions).

(The motion was then put—In favor of motion, 15 ; against, 11.)

Mr. Aylsworth—Now I would like to make a motion whether that post B would be accepted or not. I move that the post is not accepted.

Mr. Bowman—Before putting that motion I would like to speak in regard to the instructions. If I remember Mr. Speight's reading of them they were that the surveyor was to run this line in the middle of the road allowance and to plant his posts, properly marked, 50 links from this line. It does not say what post; it covers that post at B as well as those on the front of the concession. His instructions plainly cover the planting of that post. Then that certainly would govern

Mr. Sankey—I would move that the instructions do cover the planting of that post, and that that post at B was planted under instructions.

Mr. Bowman—I will second that.

Mr. Aylsworth—I say it should not be accepted I claim these are general instructions and the practice has always been not to plant a post there.

Mr. Gibson—But they were approved of by the Government and handed in.

Mr. Kirkpatrick—As a matter of fact those posts were found to be there on the ground; it was found in practice that those conflicted and the change was made. They were told expressly not to plant those posts, because there would be the place between one end of the section and the other, the center spot? If a man chains off 50 chains and puts down a post, ten to one when he gets to the upper end he is not 50 chains from it. Therefore that conflicted, and my impression is that the idea was that instructions were changed or made more perfect by saying, "Do not plant those posts."

Mr. Aylsworth—If that is the case I will change my motion, if there has been two sets of instructions made. I thought there was only one general line of instructions

Mr. Dickson—I am inclined, after hearing the instructions read over again, to think that it was certainly planted under instructions.

Mr Sankey—The instructions as read by Mr. Speight would authorize the surveyor to plant that stake at B, and as far as that stake governs and that the surveyor is satisfied by information on the ground that that is the original stake, he will be bound to give it whatever consideration any post planted under those instructions is entitled to.

(Mr. Sankey's motion was then put—in favor of motion, 16; against, 2.)

Mr. Chipman—I think we should re-consider that; at least leave it over till next year.

Mr. Aylsworth—I think that is a good idea, I would like to have those two sets of instructions Mr. Kirkpatrick talks about.

Question 4.

Mr Davis—I would produce the line.

Mr. Chipman—To my mind it would be perfectly absurd to join those two points along the town-line and divide it proportionally.

Mr. Gibson—Suppose there was only one stake there at the north-east corner of 5 in 6; the problem is to fix the south-east corner of lot 1.

Mr. Dickson—I had a case exactly similar to that. I was running out a concession line under instructions from the Crown Lands Department, and I found the post between 30 and 31, which should be about 46 chains. I remember the one concession was exactly the size and the other was some trifle over 80 chains; and I made an equal division of the property and skewed it across the last lot, and the accuracy of my survey was never questioned. It was confirmed in the Department, and the parties themselves concluded they would leave it where it was before; settled it by taking the old road where it was, and allowed each man to keep what land he had.

A Member—I had a case similar to that where the parties agreed to produce the line down to the boundary the same as it would be there between A and B.

Mr. Kirkpatrick—When I was serving my time we were making a re-survey of a whole township under instructions from the Department, and we found a post identical with the one mentioned there, B, and we found none on the south boundary, and my recollection is that we cut it off at an angle of 45°, and that road allowance is there to the present day. The surveyor I was with divided it up equally because the concessions were shown equal in the original survey.

Mr. Gibson—I can assure you that there are any number of cases which have been reported to the Crown Lands Department and approved on this principle, that if there has been an old established road between concessions 5 and 6, traveled and used and fenced, and if you can find the points, 1, 2 and 3, and C, B, and D, you have three points in the line and it is assumed that the line is not lost, when you have three points or two points. Again, the statute provides that the best evidence must be taken, and I would accept a straight line by production in a case like that. The best evidence is that there has been an established road there, and the presumption is in favor of the straight line. That is the practice of the Crown Lands Department; but if that is bush land I think the township council should close up the original and open a new one.

Mr. Speight—I will just read that clause about "the best evidence the case admits of." (Reads).

Mr. Gibson—The statute says that if "the whole concession line is lost," then you should chain through and divide proportionally. If two points can be found you join them, but if, as in this case, there is the end only of the concession line lost you will have to be very careful. In this case, the general practice in old settled sections is to produce the line.

Mr. Sankey—Has any gentleman ever had experience of a gold mine being on that little piece?

Mr. Gibson—Then you will have litigation decidedly.

Mr. Dickson—I would like to draw attention to the matter of how posts are now marked in Government Surveys. They used to be marked with a marking iron, but last summer, when inspecting Crown surveys, I found only one township where 12 posts were marked with a marking iron, the posts in the others being done with a pocket knife. Now I think they look very ugly: and in examining old posts I have heard the question asked, Is it marked with a marking iron? If it is, it is the original post; but if it is marked with a pocket knife, then discard it altogether. The instructions require it to be marked with a marking iron, but it is simply disregarded.

Mr. Niven—It is very difficult to get a decent marking iron; I have never come across a really good one. Somebody ought to invent one.

REPORT OF ENTERTAINMENT COMMITTEE.

Mr. President,—Your Committee on Entertainment for this year have to report as follows:—

In view of the satisfaction expressed by members of our Association regarding the suitability of the rooms in the Canadian Institute occupied by us during the sessions of the last two years, they were re-engaged at the same rental for this meeting.

In answer to the usual queries regarding the annual dinner, replies to the number of thirty-four were received. Twenty of these were from members regretting their inability to attend, and but fourteen from those who accepted. In spite of this disparity of numbers, the Committee decided to hold the dinner as usual, as the acceptance of others not heard from could be counted on as usual.

We were not disappointed in this assumption, and at the time appointed for the dinner—8 o'clock p.m. on the 27th February—it was found necessary to provide for 40 people, instead of the smaller number that our replies led us to expect.

This number included six invited guests: Walter Beatty, Esq., O.L.S., and M.L.A. for Leeds; Mr. Aubrey White, Assistant Commissioner of Crown Lands; Mr. E. H. Keating, City Engineer of Toronto; Mr. Sims, representing the Engineering Society of the School of Practical Science; Mr. Wright, vocalist, and his accompanist.

Letters regretting inability to attend were received from Hon. A. S. Hardy, Commissioner of Crown Lands of Ontario, and from Capt. E. Deville, Surveyor-General of Dominion Lands We were also disappointed at the absence of another invited guest, W. F. King, Esq, D.T.S., Astronomer of the Department of the Interior, who, though present at our meeting, was obliged to leave for Ottawa the day of the dinner.

After showing a due appreciation of the excellent menu provided by our host, the usual patriotic and other toasts of "The Queen," "Canada," "Ontario Legislature," "Engineering Societies," "Our Association" and "The Ladies" were honoured with the usual enthusiasm. Appropriate volunteer toasts were then proposed and happily responded to.

The excellent character songs given by Mr. Wright were well received and heartily encored. The list would have been longer had not the accompanist been suddenly called away by a message announcing serious illness in his family.

Several songs were afterwards volunteered between the toasts by members, which, though not comparable to our professional guest's brilliant efforts, were, no doubt, duly appreciated.

I have to acknowledge the able assistance of my fellow-committee-men, and beg to suggest the placing of the chairmanship in other hands, as a change in this respect would, no doubt, be beneficial.

An account, showing the receipts and disbursements of the Committee, will be placed in the hands of the Secretary of the Association, which can be examined by any member.

Respectfully submitted in behalf of the Committee,

FRED. L. FOSTER,
Chairman.

PRESIDENT'S ADDRESS.

GENTLEMEN OF THE ASSOCIATION OF ONTARIO LAND SURVEYORS:

I have much pleasure in welcoming you to this, the Tenth Annual Meeting, the third since our incorporation.

We have lost by death one of our older members, during the past year, Mr. Willian Robinson, of London, who died on the 11th of October, at the advanced age of 82 years. He was a bachelor.

I learn with pleasure that our various Committees have had a considerable degree of success in the various duties assigned them. Our Biographical Committee has secured a lot of valuable data relating to our early Surveyors—data which would have been lost forever, had it not been for their efforts.

Our Polar Exploration Committee are bringing our Association before the geographical and exploration congresses of the world.

It may not be an unprofitable task if we glance backwards, and consider on this the anniversary of our first decennial period, what has been accomplished during our existence.

Our old Surveyors lacked *esprit du corps*. When two by chance met, usually on opposite sides in court, it was some such meeting as the emissaries of hostile camps, each regarded the other jealously and suspiciously. Thanks to the good feelings, brought about by our Association, in these meetings, we now meet each other as professionnal gentlemen.

During the past nine years we have furnished nine volumes of Proceedings of our own Association besides thirty-six volumes of the Proceedings of the various State Associations in the United States. Scattered in these forty-five volumes is a vast deal of extremely valuable data, such as cannot be elsewhere found. It is useless to search the text books, for they are written to enforce general principle. The paper usually has an exact case which helps us out of the hole we were in. Our Act was in a chaotic state ; we have had it very much improved· The Ditches and Water-course Act and The Municipal Drainage Act were also in a deplorable state. It is to this Association the credit is due of inaugurating a remedy for the defects and by the aid of its members has helped to place upon the Statute Book Bills which, while they may not accomplish all we hoped for, are at least a marked advance on what preceded them. We may hope for more drains as the result, and better drainage means a healthier and more prosperous community.

And when we consider the changes being brought about with bicycle, electric motive power, and improved systems of transportation we see where the farmer's market for his horses, hay and oats have gone to. Our Dairy interests to-day supply the Ontario farmer with ready cash for his various wants. But in the transitional stage from the old to the new, the country as a whole has suffered and it would be unreasonable on our part to expect that we alone should be exempt from the general dullness of business.

We shall have to study economy closely in any work which it falls to our lot to carry on. Do not spend one dollar that can be saved. In this way our public works may hope to earn a reasonable return on the capital invested in them.

In union there is strength —united we stand, divided we fall. These are troublous times in the commercial world, and it behoves us to do our part to protect ourselves and to seek to hold what we have gained. At the annual meeting of the Canadian Society of Civil Engineers this year, generous tribute was paid to the fact that the Ontario Association of Land Surveyors was a strong united and aggressive body, incorporated by Statute and therefore occupying a point of advantage they hope to reach.

We have yet much to do. Our Topographical Committee should submit a project to begin a Topographical Survey of the Province. Our various Committees are at present consulting Surveyors for the profession. More may be done towards assisting the younger members. Our Legislation Committee should have in mind improvements to our Act. Our examinations should be made broader so as to include Mechanics, Hydraulics, etc., working up gradually to the standard exacted for a Borough Surveyor in England.

In conclusion, gentlemen, I trust that the same spirit and harmony of good fellowship will be found in this meeting that has characterized those in the past.

PAPERS.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

A HANDY METHOD OF INDEXING OFFICE INFORMATION.

By D. D. JAMES,
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THIS paper is presented with a consciousness of the fact that there are and have been many excellent methods of indexing office information all more or less peculiarly adapted to the circumstances under which they have been created. The author believes that the success of any system of indexing depends on its being adapted by its users to the particular circumstances under consideration, and that this adapting is a matter almost of mathematical calculation. For having our information of whatever nature duly designated, filed, and stowed away in a shape such that knowing the designation of any piece of information we can immediately turn it up, the problem is logically reduced to this. In any particular case the unknown quantity is the designating figure or letter, while the known quantity is some definite or indefinite knowledge of the information itself. Now, the index must be some method of arranging what will be the known definite or indefinite information in such a manner that we can obtain the unknown designating letters and figures from it.

Now, before going further, it will be necessary to dwell on the particular nature of the information for which the system about to be explained was intended. The information is, all information, of whatever kind, which an Ontario Land Surveyor collects in the pursuance of his duties as an Ontario Land Surveyor. To begin with, the Land Surveyor is required by Sec. 70 of the Act to " keep exact and " regular journals and field notes of all his surveys and file them in " the order of time in which the surveys have been performed, and " shall give copies thereof to the parties concerned when so required," etc. The filing in order of time here seems to be a hint of the method which the surveyor should employ to find the information when required to give a copy. But all surveyors know that to attempt to find the information this way, especially in a long established surveyors' office, would be attended with annoyance and besides wasteful of time just when time would be most valuable. Besides this the surveyor wants back field notes himself to help him, in other work in the locality, and he has no idea perhaps of the names of clients or of the dates of surveys made there. So there must be some method of indexing this information so as to be readily turned up. Then, besides field notes, the surveyor must for his own benefit keep copies of all plans he makes and generally keeps copies of all plans on which he has had to make a survey at all. The reports also which are given by a surveyor in the shape of descriptions and sketches may be regarded by some as worthy of indexing along with the other information. Now, seeing that the information consists of Field Notes, Plans and Reports of Surveys, we must decide what element we shall use in making the Index. We have (1) Date of Survey or Plan, or of Report, (2) Owner or Agent concerned, (3) Locality of Property Surveyed, as probably known elements by means of which we expect to turn up our information. The best possible method of indexing will be one in which we can find any piece of information from a use of only one of the above elements providing that we can be certain in every case that we shall know that element. Take the first element mentioned, may we always expect to know date of survey in hunting for information ? No, often not. Thus we see that the plan hinted at in the Surveyors' Act is not general.

Let us try the second element mentioned. Do we or our clients always know the name of the Owner or Agent for whom the survey we hunt for was made. No, we do not. This like the first is a mere incident of the survey. Now, lastly, do we or our clients always know the locality in which the survey was made. Yes, certainly ; otherwise our clients could hardly know what they were talking about. So our conclusion is to have an index depending on locality. One way to do this is by means of streets. A large book like a ledger may be used, an account, as it were, being opened out to each street. On the right half of each page the cross streets, between which the information lies, are given and on the left half is the book, page, cabinet, drawer or file number needed to find the information. The entering on the pages is made as the information is gathered This system is in use in at least one office in Toronto with regard to field notes, but why should we not use it for all information. Such is the method clearly outlined in "The Michigan Engineers' Annual for 1894" by G. M. Ames, where engineering notes of all kinds, profiles, and plans are all indexed promiscuously as far as anything other than locality is concerned.

Some surveyors depend on an index according to registered plan numbers to find their plans—but sometimes we have private plans on file which cannot be reached by such an index. This would not occur in the index spoken of above.

Now, a large plan would need to be indexed on more than one street, and so would extensive field notes, and if we have so much information under one street heading it will surely take time to single out the information we want, and it thus becomes necessary to further classify, especially in the case of a long street. This could be done by allotting so much space for each block under the same street heading. The space needed would be probably proportional to the length of the block. We find, then, that our index has assumed more or less the proportions of a plan, and such we might make it only without depths shown. Or, if we have a plan on a large scale, it would make an admirable place to index all information. Such is the handy method which I wish to bring forward in this paper. This would suit well in some offices, for, perhaps, the surveyor has drawn up a plan of his whole district in the hope that he could put all his information on a large scale plan, and has found at last that he has no confidence in second hand information—*i.e.*, information put on the map from field notes or plans by some unreliable office boy or assistant—and so throws aside this plan, which could be easily turned into an index An inexpensive method would be to use any atlas or compiled plan which has been published in the district, and if it were considered undesirable to mark up the atlas by index marks a tracing might be made inking in only the principal outlines and names of streets, etc , or tracing linen could be pasted by one edge over the plans in the atlas and the indexing could be done on the linen, the atlas plan underneath showing the locality to which the index marks refer. Goad's Atlas of the City of Toronto would do admirably for this purpose, and it might pay a surveyor here to have a duplicate copy solely for an index.

The method would require a plan wherever there was work done, but it is evident that a smaller scale would be sufficient the farther the survey were from the particular surveyor's headquarters. An atlas of Ontario would be the outside limit for an Ontario Land Survey. Then, perhaps, he could use his county atlas for nearer surveys and so on.

On the index map the information should be written with a fine pen and as concisely as possible, as, F.B , 1—21, for Field Book No. 1, Page No. 21. Registered Plan numbers and the corresponding office file numbers should be put together, the Registered number being distinguished by a circle or brackets. If the Registered Plan has not been drawn by the surveyor, but he has it copied in a sketch book, he can index opposite the Registered Plan : No. S.B., 1—81, for Sketch Book 1, Page 81. Then, if there are private or unregistered plans these can be indexed also. Thus, everything can be indexed in one and the same system.

When, in the course of years, an index plan gets pretty well filled a new one can be begun on a larger scale for that district, the index numbers being easily transferred, or the old plan may be used as an index for all surveys before a certain date, and the new one may be used only for new information. Recent surveys can be distinguished also by the higher designating numbers used, so that no fault can be found with the system in that old and new surveys and plans are mixed up.

Further, we can turn up plans without a knowledge of their registered numbers and an indefinite knowledge of locality will serve to turn up any information in the office. The bare skeleton of this system then consists in an index map and the writing of a letter and the number upon it for each piece of information in the office. This indexing must be done very carefully and so as to indicate as well as possible the extent of the information, and the references may be thus entered sometimes twice or in large letters.

Of course a plan index, by means of which we can turn up registered plans from a knowledge of their registed numbers, would, perhaps, be convenient, in addition, and would serve a good purpose if there were errors in indexing on the general index map; but it would not be essential.

So also we may have an inventory of plans in the office, in order of time, as filed, so that we may be protected from loss of them. And with field notes also we may have an index in the back of each field book. It often proves useful in the field if we have lost the page in the book on which our information is. All these things, though, could be dispensed with in times of great pressure of work. Another thing worth mentioning is, that if it is thought necessary to have an index by means of which we can turn up information from a knowledge of the client's name we can accomplish it by means of the ordinary account ledger; for in it we can turn up the man's name and account and there find the order book page, entered there for that and other purposes. In the order book we can find the locality and hence the information from the general index map or we may have the field book references entered in the order book so that we need not go to the general map index.

In closing I would say that to me there is no question of the great convenience of the general map index; the only question seems to be that of getting a suitable map to index on, for if too small a map is used great slovenliness will no doubt result.

DISCUSSION.

Mr. P. S. Gibson—I think this is one of the most important papers we have to discuss to-day. In the cities you have your wards and streets, but with a country practice mixed up with a city practice it is quite a problem. My rule is to have a field book about 6x8 inches which I carry with me and make my sketches in the field, and write up the whole particulars. Sometimes I write the affidavits and enter them right in the field book too, so if I am called upon to give evidence in court, there I have a picture of the whole thing with me. Another advantage is when you do your work in the field and have it well worked up there you are sure it is right. An old surveyor once said to me, "Peter, the first thing you do when you are making a survey is to make up your notes as perfectly as you can and then sit down and explain to the farmers what you have been doing; and while you are doing so you will generally find you have made a mistake somewhere." I have the field books carefully tinted and written up so that I can distinguish the portions I want to work upon. I write a full description of of everything I have done. If the parties give me instructions to do it as I please and mark everything, I put it down that way, but if they don't want to go to too much expense, I do it to suit them ; and when I get to my office, may be some rainy day, I index these books, the township, the concession, lot, year, month and day, the pocket in which these descriptions go, the owner of the property and the surveyor, too, because sometimes I have field notes of other surveyors, and these I classify in the same way. I always copy my descriptions of property in my letter book ; and I have an index in my letter book on which is entered up the concession and lot, the date and page. Now I have purchased about fifteen or twenty pretty large blank books, and I am going to index all my notes and all my father's notes, and copies of registered plans—and I have thousands of them. Every lot will be entered in these books, every survey, description and plan I have that relates to it goes right down on that one lot.

Mr. C. F. Aylesworth—As far as my practice goes, I have a large blank book, and I write down the different townships in that book, and then I go over the field books once every six months or so and enter under each township the work done in that township, the concession and lot. That is as far as country practice is concerned.

Mr. Chipman—I think the method I explained to this Association several years ago is, to my mind, the best yet brought forward ; that is to keep the books exactly as they are kept in the registry office. Open one page or part of a page for a lot in a certain township, and index in that every note you have, plans and everything else. As soon as a field book is filled with notes, "post" it into your index book. You have then everything included in that, not only your notes, but all notes and plans in your office. I don't think the plan suggested by Mr. James would answer for ordinary country practice.

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FLOOD PREVENTION WORK AT BRANTFORD.

BY C. C. FAIRCHILD,

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DURING the winter of 1893-4 the low lying portions of Brantford were visited by two very severe floods, the first being on December 24th, 1893, and the second on March 5th, 1894. The latter, which was, perhaps, the more disastrous, owed its extreme height to the ice jam which took place at Two Fish Islands about a mile below the city.

The water at its greatest height stood at about 71.80 on the city levels at points above the dam, or about one foot heigher than the last severe flood in 1887, while, below the dam, it reached an elevation of 66.80 at points east of Market street, or about three feet higher than in 1887.

The City Engineer, Mr. T. Harry Jones, A.M., Can. Soc. C.E., reported to the Council on January 8th, 1894, recommending the construction of a dyke for the protection of West Brantford, which is situated above the dam. No action was taken on this report, but after the second flood of March 5th, the Council adopted a report of the Board of works instructing the City Engineer to prepare a report on the causes of the flood and to suggest remedies.

After careful surveys and taking a mass of evidence on previous floods and their causes, a report was submitted on May 14th, 1894, in which the matter was very thoroughly discussed.

In this report the causes were given as:—

(1) General.

(2) Local.

GENERAL CAUSES

Under this head it was pointed out that year by year the floods were increasing in volume and suddenness owing to the clearing up of the forests along the river and the construction of drains running through these cleared districts into the river. The river was also carrying down gravel and sand from its banks above and depositing it in the bed of the stream, thereby blocking the channel and causing diversions of the stream and thus lessening the discharging capacity of the main channel of the river. Again the thaws were more sudden in the open or cleared lands, thus causing the ice to break up more quickly and in larger blocks, and consequently enhancing the danger of ice jams which are often the most dangerous feature in a winter flood.

LOCAL CAUSES.

Under this head attention was called to the dam which is primarily the cause of the extreme height of water in West Brantford. A new dam had just been constructed and the old one was still in position so that an increased obstruction was offered to the flow of the river. The difference in level above and below the dam during flood time corresponds with the difference in the levels of the river at its normal height, except in case of high water caused by an ice jam at some point below the dam.

The extreme depth of water in Eagle Place, which is below the dam, was owing in a great degree, to an ice jam at Two Fish Islands, at which point the channel takes a sharp angle, and is further obstructed by a number of islands covered with large elm and other trees, the whole forming a lodging place for ice which renders it a menace to the inhabitants of Eagle Place and other low lying positions of the city below the dam.

There are also two railway bridges across the river below the dam and to these the people of Eagle Place owe at least a part of their discomfort. Both the Grand Trunk and the Toronto, Hamilton and Buffalo Railway Companies have narrowed the channel, and in the case of the latter the elevation of their bridge is considerably below the extreme height of flood level.

Two natural courses were open for the prevention of further floods, viz.

(1) Deepening the channel of the river so that it would accommodate the waters at highest flood level.

(2) Raising the banks to a height above the highest flood level.

The idea of sufficiently deepening the channel was impracticable both because of the presence of the dam and of the expense incumbent on an undertaking of such magnitude, and it was accordingly decided to erect dykes or embankments along the margin of the river, and to take the material for the construction of these embankments from the channel of the river in as far as practicable, thereby making to a certain degree a combination of the two methods above suggested.

The West Brantford work was first carried out. This consisted of the raising and enlargement of an old dyke along the Western limit of the city, built a few years before for the protection of West Brantford from the overflowing of D'Aubigney Creek and the extension of this dyke to the river bank and thence along the margin of the river to intersect the G. T. R. Company's track. This old dyke, which was 1,730 feet in length, was raised one foot bringing it to an elevation of 73·00 on the city levels, and the balance of the work, when completed, was brought to the same elevation. The embankment is 8 feet wide on top with a slope of 1½ to 1, and contains 10,060 cubic yards, having a fall of from 3½ to 11 feet and a varying bottom width of from 19 to 38 feet. About three-fifths of the earth for this embankment was procured from a small island lying in the river opposite the dyke, the average haul being about 600 feet. This island was entirely removed and this removal alone will do much to alleviate the tendency to ice jams at this point, as the island was situated at a place where the channel is very shallow. The balance of the earth was procured from the bed of the river between the railroad bridges, the average haul being about 1,800 feet.

The total cost of this embankment was $2,480, or at the rate of about 22½ cents per cubic yard, the work being performed by the city and under the direction of the City Engineer and Overseer Howie.

Four cribs were erected along the river bank to assist this dyke to withstand the inroads of the river, the first being situated at the upper extremity of the embankment and the others at such points as it was felt they would be of most assistance to the dyke. Three of these cost $300 each and the fourth $200. They were sunk down below the bed of the river and raised to an equal elevation with the dyke being firmly imbedded in it at one side. These cribs were made of pine timbers 10 inches square fastened together with half inch drift bolts 18 inches in length.

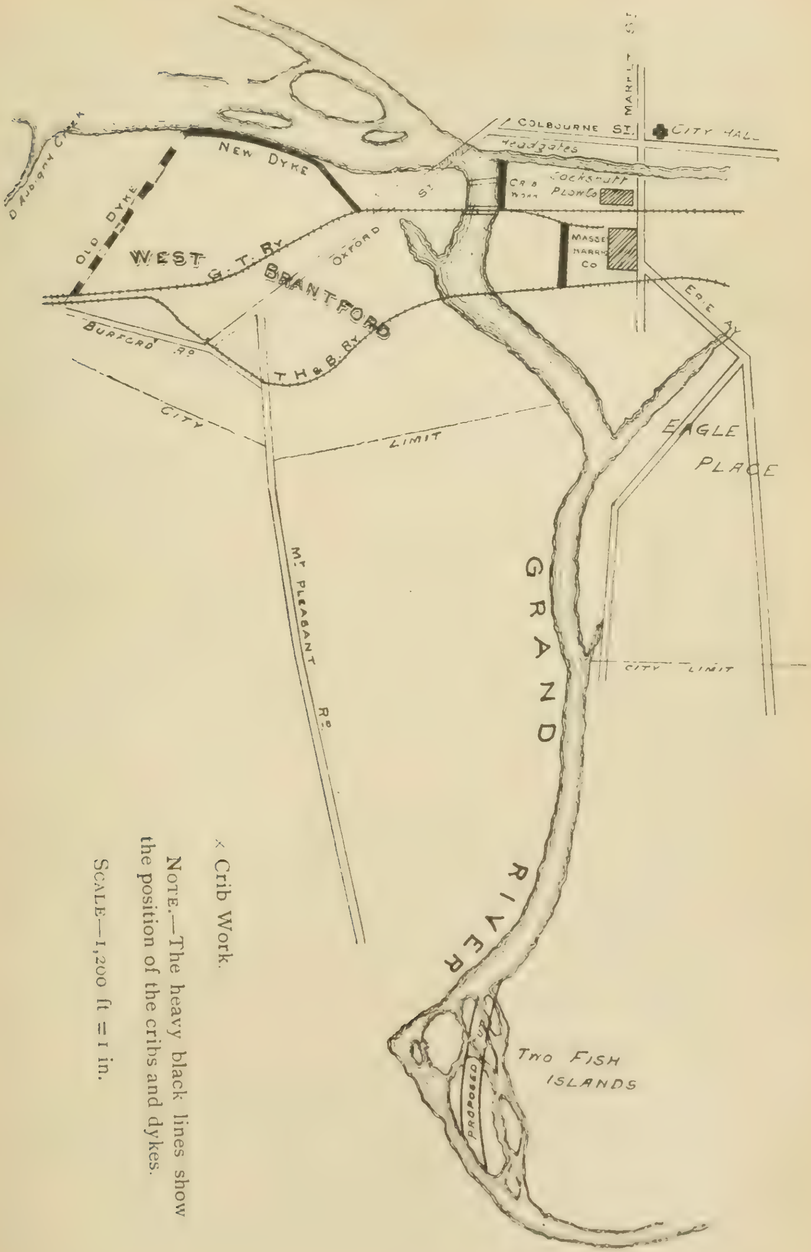
When this work was completed attention was turned to the headgates and cribwork below the dam and further dykes for the protection of Eagle Place. An embankment was built from railway to railway, but the raising of the T. H. & B. Ry. Companies' track and bridge has not yet been carried out.

The headgates were replaced by the Brantford Electric and Power Company according to plans and specifications prepared by Mr. H. K. Wickstead, M. Can. Soc. C.E., who also consulted with Mr. Jones on the work between the dam and the G. T. R. bridge, one-half of the expense for which was borne by the Electric and Power Company.

In the City Engineer's report it was recommended that this work be a solid faced crib raised to the elevation of 73·20 or about 12½ feet above the crest of the dam which is about 5½ feet above low water mark below the dam. Mr. Wickstead suggested that instead of bringing up the cribwork to this elevation that it be brought up to the level of the crest of the dam and from this to raise an embankment to be faced with loose stone. The work was carried out on this plan excepting that the back of the cribwork was raised 4 feet higher than the front which was brought to the level of the crest of the dam thus giving a slope of 3 to 1 to the top flooring of the crib, which was 12 feet in width. The embankment having a top width of 8 feet was carried up back of the crib on a slope of 2 to 1, and was faced with stone procured from the bed of the river, while the face of the cribwork was protected by piling stone along in front of the crib. The timber used was hemlock below water line and pine above, all being 10 inches square with a flooring on top 3 inches in thickness.

The total length of this work is about 180 feet and the total cost $2,200. This crib is in a peculiarly exposed position, being just below the dam and on the side of the river against which the whole strength of the waters is thrown in flood time. During the last flood the water and ice swept over the banks at this point doing great damage to the large factories situated on the flats.

As an assistance to the dykes and to prevent further ice jams a cutting was recommended at Two Fish Islands, but this has not as yet been carried out. The efficiency of the dykes depends, in some measure, on this work, and it is to be hoped it will be carried out this



× Crib Work.

Note.—The heavy black lines show the position of the cribs and dykes.

Scale—1,200 ft = 1 in.

summer. There was a question raised by the City Council as to their power to do this work, which is outside the city limits, without special legislation. There is some doubt as to whether the Drainage Act covers the case or not and it will be interesting to engineers when a settlement of the question is reached.

Other work not described in this paper has been done, the total expenditure being $6,600. The accompanying plan shows the location and extent of the work.

DISCUSSION.

Mr. H. J. Bowman—I suppose the necessity for works of this kind is increasing all the time. No doubt years ago the Grand river was comparatively a quiet stream. That is generally found to be the case, but with the opening up of the country the water comes down so fast in the spring that it necessitates these works. I know farther up the stream they are having difficulties; railway tracks are being flooded that in years gone by were always dry. The cause, I suppose, is the drainage of the country; the clearing away of the timber and swamps, and the water rushes through the larger drains into the river, causing the floods.

The President—In Belleville, at the mouth of the Moira river, the causes are slightly different. There the water used to freeze to the bottom of the river, it being very shallow, and the water would come down in a flood in the spring and the ice from above would keep piling up, so they have gone to work and dredged a deep enough channel for the water to escape under the ice. In that way, while they have not got over all their trouble, they have improved their condition very much indeed, though it has cost a lot of money, it being all rock excavation. They have also embanked the shores to some extent.

Mr. T. H. Jones—In reference to the flood level increasing in height year by year, of course that is a common experience. As Mr. Bowman says, there is much more extensive drainage year by year; and not only that, but as the forests are cleared up the frost strikes deeper into the ground, and the water is carried off so much more quickly. There I had evidence extending back thirty-five years that, apart from the ice jams, which of course are another feature in connection with it, only at one time in that thirty-five years had the flood level approached to within two feet of the height—it was during this last flood.

Mr. P. S. Gibson—I think I have a case a little different from either of you. The trouble with us in the County of York is that the rivers are digging their own bottoms out; and it is difficult to keep them from tearing the adjoining lands away and forming an island in the bay. For many years, away back when I was a lad, in the township of York, there were mill dams almost every quarter of a mile, but at the present time, for twelve or fifteen miles from the lake, there are only one or two dams, and they are carried away whenever there comes a crush of ice. Now I am called upon from time to time to protect the banks, and my practice is to drive cedar piles down and fill in the bank with brush, gravel and willows—I plant a great deal of willow. The object of the brush is when the bed of the river is dug out year by year—and it goes from three to five feet sometimes—the brush settles down to the foundation, and we build on top then or drive the piles deeper. Another trouble I have is with the foundations of our bridges; when the bed of the river is lowered the foundation disappears, and the result is we have to give plenty of water way. As a rule, I put no cribbing in at all, but simply put in piles; and instead of attempting to retain the embankments I extend the ends of the bridges and give lots of water way. In the last sixteen or seventeen years we have not lost any bridges at all, so that my system of protecting the banks with cedar piles, brush, gravel or stone, and planting willows, is a good one. We find our cedar piles last a great length of time.

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EXPLORATIONS AND SURVEYS IN RAINY RIVER DISTRICT FROM 1717-1894.

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IN 1716 Vaudreuil, then Governor of New France, with a view of extending the fur trade westward, gave instructions to Lieutenant Noue to explore the country to the west of Lake Superior. Noue began by rebuilding the Trading Post on Kaministiquia River (where now stands Fort William) which was first built by Duluth in 1678. In the fall of 1717 Sieur de la Noue penetrated as far west as Rainy Lake (Lakemanigen or Lac la Pluie) on the west shore (north of Pithir's point) and build a trading post, the first established in Rainy River District. For several years following he occupied his time in extending the fur trade in the Rainy Lake region and bringing about friendly relations between the different Indian tribes. But the man to whom is due the most honor as one of the earliest and greatest explorers of this Western district is M. de la Verendrye, who in 1728 was in command of a trading post at Lake Nepigon, and who had for several years remained in obscurity as a trader in the region round Lake Superior, though his early life was a brilliant one, a victor in two campaigns, one in New England in 1704, the other in Newfoundland, 1705. As the discoveries with which Verendrye's name is associated are but little known, and although I cannot speak at any great length in this paper, I will mention a few occurrences which may throw some light upon their discoveries. With the hope of discovering a Western sea he laid his scheme before Beauharnois, then Governor of New France, who, after some delay, consented to the proposed western expedition, and, in order to meet the cost of the same, gave Verendrye the exclusive profits of the fur trade over the territory to be explored. On the 19th May, 1731, he entered into company with men in Montreal who advanced goods and equipments, taking with him his three sons and nephew and Father Messager as missionary, besides several French voyageurs. We will then follow them from Kaministiquia where they arrived from Mackinaw (Michilimakinac) in the spring of 1731. He found himself at the grand portage on Lake Superior, 10 miles south-west of the mouth of Pigeon River, westward bound on the 26th August, 1731. After many a struggle through lack of means we yet see their parties the same year successively pass through Rainy Lake (Lac la Pluie), at the outlet of which they established Fort St. Pierre about 1½ miles below the present H. B. Co's post at Fort Frances.

Thence passing down Rainy River, across Lake of the Woods (Lac Minitre or Des Bois), on the south-west shore of which, in Buffalo Bay, near the mouth of War River, they built Fort St. Charles in 1732. They traversed and traded throughout the whole Winnipeg basin before 1750, after building forts on Rainy River and Lake of the Woods in 1731-32 and shortly afterwards on the Winnipeg Red and Assiniboine Rivers, taking possession also of the Upper Mississippi and Missouri to their source, they subsequently extended their forts on the lakes and rivers northwards to the Saskatchewan on which they and their successors had, up to 1755, built no less than five forts. They explored the Upper Missouri in 1742, and by the Yellowstone River reached the Rocky Mountains at the base of which they, in 1743, built a fort, thus commanding the whole trade of that vast region which they called the posts of the Western sea. One of these expeditions cost one of the sons his life, for a band of Sioux Indians massacred him with his whole party of twenty-one men in June 1736, on an island in the Lake of the Woods, near Rat Portage. Among the slain was Father Annean. Their bodies were discovered several days after the event. The bodies of the Frenchmen were placed on beaver skins, the greater number of them scalped. The missionary had an arrow in his head, his breast cut open. The explorer lay face down, his back hacked with a knife, a hoe buried in his headless body which they had ornamented with porcupine quills. The father, who was at this time in great destitution at Fort St. Charles, heard of the massacre of his son and the death of his nephew at the same time; but his devotion and courage, undismayed neither by misfortunes nor dangers, he continued the expedition, but it was only in 1743 that the eldest son and his brother reached the Rocky Mountains, returning the same year to Fort St. Charles on the Lake of the Woods, where they again joined their father, who, becoming discouraged at the unjust treatment he received from the King of France, returned to Quebec and died 6th Dec., 1750, leaving his two sons to carry on the work, which they did for several years in the Lac la Pluie region, and around the head waters of the Mississippi. The breaking out of the seven years war in 1757 ended their explorations and they re-entered the army. This war, which occasioned to France the loss of Canada, gave them both an opportunity of ending their lives nobly on the 15th Nov., 1761. They were both drowned on the wreck of the *Auguste*, and needed no longer to envy the death of their brother who was killed by the Sioux; but in viewing the misfortunes of their country they could say, "We die, but we die with it." Such is given as briefly as possible the unfortunate but not inglorious life of these brave explorers.

As to the Lac la Pluie District, it is a matter of history that from the period of its first discovery in 1717 the French traded and occupied the whole district, while the Hudson Bay Co. had, up to 1790, but one post on these inland waters, Cumberland House, on the Saskatchewan, built by Hearne in 1774, and up to this time no servant of the Hudson Bay Co. had set foot on these inland lakes. In 1790 the Hudson Bay Co. established a post on Red Lake trading into Lake of the Woods. The cession of Canada, 1783, caused many of the old French traders to return from these Western posts, but the same year they formed themselves into the North-West Trading Co. with headquarters at Montreal. They soon rose to the position of formidable rivals of the Hudson Bay Co., and, in 1817, the district traded in by the two companies became the scene of animosities, feuds and bloodshed, involving the destruction of property and the demoralization of the Indians and the ruin of the fur trade; so much so that the Hudson Bay Co., who had, prior to 1800, been able to pay from 25 to 50% dividends were for the preceding 22 years only able to pay 3% per annum. The war between the two companies ended 1821, a union being arrived at under the name of the Hudson Bay Co., which company practically remained in undisturbed possession of the country between Lake Superior and Red River up to 1857.

By the Treaty of Paris, dated 3rd Sept., 1783, the Southern Boundary of Canada was defined, and later by the Treaty of Amity, Commerce and Navigation on 19th November, 1794, and still more definitely by the Treaty of Ghent, signed Dec. 24, 1814. By the 6th and 7th articles of said treaty Great Britain and the United States each appointed a commissioner, Anthony Barclay and Peter B. Foster, with David Thompson as surveyor to locate the boundary between the two countries. David Thompson was the first surveyor to receive official instructions to make a survey touching the District of Rainy River. He was born at Westminster, England, 30th April, 1770, entered the services of the Hudson Bay Company at Cumberland House, 1789, and spent the next eight years in exploring and mapping out the country traded in by said company and locating their different trading posts. In 1791 he entered the services of the North-West Company to perform a similar work; in Feb., 1798, he started with a dog team from Red River to explore the country between that river and Lake Superior; on April 27th he reached Turtle Lake, from which flows Turtle Brook, which he states to be the source of the Mississippi. Thus to this almost unknown geographer belongs the honor of discovering the head waters of that great river. From 1816 to 1826 he was engaged in surveying and defining the boundary line on the part of Great Britain between Canada and the United States. In August 17th, 1822, while on the survey of Lake Superior, he instructed his assistant, J. G. Sayer, formerly a trader in the service of the North-West Co, to explore the country between Fort William and the shores of Rainy Lake, and, on 29th August, Sayer started up the Pigeon River. The two following years Thompson was engaged on the survey of the different lakes and streams adjoining the boundary between Lake Superior and the west shore of the Lake of the Woods. On July 25th, and 26th, 1824 he planted the monument marking the north-west angle of the Lake of the Woods, being the south-west angle of Ontario. I am probably safe in saying that no other land surveyor has made so extensive surveys as Thompson, a survey extending nearly from ocean to ocean and from the Ohio River to the Hudson Bay. His deeds have never been trumpeted as those of some others, but in the northern and western explorations for the fur companies in their palmy days no man performed more valuable service or estimated his achievements more moderately. He died in extreme poverty near Montreal, on 16th February, 1857.

In 1857 the Provincial Government, with a view of establishing suitable communication between Lake Superior and Red River organized an exploration party under George Gladman as Chief, Professor Hind as Geologist, W. H. Napier as Engineer, and S. J. Dawson as Surveyor. The primary object of the expedition was to make a thorough exploration of the country between Lake Superior and Red River. The party left Fort William on July 31st arriving at Fort Frances August 18th and at Fort Garry September 5th of the same year. The party continued their explorations through 1858. One of the results of this expedition was the building of the Dawson Route which served as the chief highway to Red River till the completion of the C.P.R On March 31st, 1857, instructions issued from Her Majesty's principal Secretary of State, London, to Captain Palliser to explore the region between the west shore of Lake Superior and the Rocky Mountains, but more particularly between Lake Superior and Lake Winnipeg. In company with four other scientific gentlemen they arrived at Fort William en route up the Kaministiquia River on June 12th, and made a rapid exploration of the canoe route between Fort William and Rainy Lake, arriving at Fort Frances July 1st, and at Fort Garry on the 11th, collecting sufficient information on their rapid journey to enable them to form some idea of the resources of the country passed through, and taking numerous observations on the route, they arrived at the Rocky Mountains 1859.

The outlining and subdividing of Townships within this District was begun by the Dominion Government in 1872, and by the Ontario Government in 1888. Since 1872 twenty-eight townships, comprising an area of 493,000 acres, have been subdivided into lots of 80,160 and 320 acres, and along the banks of Rainy River into lots from 50 to 200 acres with a ten chain frontage on the river. No less than 775 miles of Base and Meridian lines have been run during that period, not including the outlines of the Townships subdivided, but including 126 miles of the eastern boundary of the District which is run due north through the most easterly point of Hunter's Island, crossing the C.P.R. east of English River Station. This boundary was established by an Act of the Provincial Parliament on the 30th March, 1885, when Rainy River was set apart as a District.

Within the District nearly 1,300 mining locations and islands have been surveyed under the Mines Act by private individuals Extensive timber surveys have been made in the southern portion of the district. In 1890 and 1892, 370 square miles were sold by public auction for $254,600 bonus, or nearly $700 per square mile, besides stumpage dues of $1.00 per thousand, which, with the bonus, will amount to nearly $2,000 per square mile, from which we can form some idea of the value of the extensive pine lands in the southern part of the district. Tamarac, suitable for building and railway ties, spruce and poplar, suitable for pulp wood, is found in great abundance throughout the whole district. Between 1883 and 1893 the Geological Survey Department of the Dominion made a geological survey of nearly the whole district lying south of the C P.R., making comparatively accurate traverses of most of the large lakes and main water ways.

Agriculture is, perhaps, one of the most promising of the economic prospects of the district, and will in this sense be largely determined by the facilities offered for the development of other industries such as its forests, mines and fisheries. Rainy River forms its source at Rainy Lake; to its mouth at Hungry Hall flows for eighty-five miles through a rich, alluvial plain, of the post-glacial formation, with clay banks rising on either side from ten to twenty-five feet high and an almost unbroken stretch of fine agricultural land on both the Canadian and American sides extending inland from six to twenty miles. The whole valley is covered with timber suitable for building, ties, pulpwood or fuel. From what I have seen of the Rainy River basin, I should say there is an area of no less than 800 square miles on the Ontario side, 65 per cent. of which is first class agricultural land, and the balance capable, when drained, of making good pasture land. It is entirely free from stone or rocks, well watered by small streams, and where settlements have been made well opened up with colonization roads. Many smaller tracts of flat lying land, probably old post-glacial lake bottoms, suitable for agricultural purposes, are to be found throughout the district. South of the Namekon River, along Rat and Big Turtle Rivers and many other streams, an extensive tract of the post-glacial formation, similar to that along Rainy River, extends along the Wabigoon River and around Wabigoon and Eagle Lakes.

The mineral wealth of this district, although hard to estimate, bids fair to be even greater than that of the timber and agriculture. The discoveries thus far establish the existence of unlimited deposits of rich iron ore along the Atikokan and Lime River; and, on the south side of Hunter's Island, gold has been found in paying quantities in several mines on the Lake of the Woods; while Rainy Lake and Lime River are having a gold boom at present which promises to assume considerable dimensions, and several stamp mills will be in operation before many months.

The Indians within the Rainy River District are Saulteux of the Ojibway nation. They derive their name from Sault Ste. Marie, from the neighborhood of which they originally immigrated. These Indians are embraced in what is known as Treaty No. 3, negotiated at the north-west angle of the Lake of the Woods in 1873, by Lieutenant-Governor Morris This Treaty ceded some 35,000 square miles to Ontario and settled any difficulties that had arisen out of the encroachments of Canadian settlers and surveyors on what the Indians had regarded as their lands. Most of them still cling to their Pagan faith, and the habits and customs incidental to their unconverted condition; and, although rather hostile to christianizing influences, are not deficient in many of the qualities that command respect. They are brave, fairly honest and active, and good workmen when kept at it, and among themselves very capable of self-government. The bands on Rainy River and Lake of the Woods meet frequently in council, discuss their affairs very intelligently, and enforce sternly the rules necessary for their common welfare ; and, while mostly retaining the primitive wigwam and practising Pagan rites, they are in some instances far more thrifty, prudent and industrious than many of their race. Within the district the forests yield them abundance of game and the lakes an unlimited supply of fish ; the immense marshes produce large quantities of wild rice, while the more industrious grow maize, potatoes and other vegetables. Within the district there are no less than sixty Indian reservations surveyed, containing 540 square miles. Around the Lake of the Woods and north on English River and Lac Seul the Indian population does not exceed 1,900, of which about 600 trade into Lac Seul, while along Rainy River and around Rainy Lake and on the eastern part of the district there are about 1,000, or a total in the district of about 3,000 In 1877 there were 2,890, and but a few years prior to the year 1856, 3,150. These are known to the Hudson Bay Company as the Lac la Pluie Indians ; 1,500 of them traded at Fort Frances when David Thompson made his boundary survey in 1823.

The southern boundary of the district between the north-west angle of the Lake of the Woods and Chaudiere Falls at Fort Frances was settled by the commissioners appointed under the sixth and seventh articles of the Treaty of Ghent, December 24th, 1814. The southern boundary east of Fort Frances was finally defined by the Ashburton Treaty, signed August 9th, 1842.

The northerly and westerly boundaries were defined on the 3rd of August, 1878, by the award of five arbitrators appointed by the Government of Canada and Ontario.

The eastern boundary was established by an Act of the Ontario Legislature on 30th March, 1885.

The Report of the Judicial Committee of the Privy Council, establishing the boundary between Ontario and Manitoba, bears date July 22nd, 1884, and was confirmed by her Majesty in Council, 11th August the following year.

DISCUSSION.

Mr. Speight—I think we are much indebted to Mr. Whitson for his very able and interesting paper. It is very apparent that he has gone to a great deal of trouble and research in getting all these facts. One thing I noticed in the biographical sketches that we listened to this afternoon was that Mr. Thompson's name was omitted. I think a paper on the life and doings of this surveyor would be one full of interest and instruction to the profession. It is very apparent, also, that the surveyors are the pioneers of civilization. I have, therefore, great pleasure in moving a vote of thanks to Mr. Whitson for his able paper.

Mr. Dickson—In seconding the vote of thanks, I may say that I am personally acquainted with a limited portion of that country, and as far as I know, it quite bears out every word that Mr. Whitson has said.

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THE EIGHTIETH MERIDIAN, CANADA.

By WILLIS CHIPMAN,
O. L. S., etc.

The object of the writer in presenting a paper on the above subject is to awaken an interest in our northerly heritage among the Land Surveyors, who are, as they should be, the pioneers in developing the natural resources of our country.

Few realize the vast extent of the territory north of the international boundary line. From Cape Breton to Vancouver Island, a distance of nearly 4,000 miles, Canada can be traversed by railway, and many books have been written on our potential wealth from the car windows. But the strip of territory that is well known, or that has been fully explored, is comparatively narrow.

In our own Province it may seem surprising to many to know that the trans continental line of the Canadian Pacific Railway divides the Province into two parts of nearly equal areas. The northerly half of our Province, according to the above division, is probably as little known to-day as it was two hundred years ago.

The writer believes that when this territory becomes thoroughly explored and examined that it will prove to be a source of wealth to our Dominion, rich in minerals and in timber, and not without value to the agriculturist.

The impossibility of finding coal in northern Ontario has yet to be demonstrated. It is quite possible that some detached areas of carboniferous rocks may yet be found that may contain beds of merchantable coal. Quite recently an isolated area of Cambrian rocks has been found near Sudbury, and a small area of Niagara at the head of Temiscamingue.

In this paper the strip of territory described has for convenience been divided into four divisions and twelve sub-divisions

From the shore of Lake Erie to the shore of James Bay is a distance of about 570 miles, or as far as from Montreal to Windsor—all Ontario. This comprises the first division.

North of the Ontario division lies the great Hudson Bay division, about 792 miles in length, a vast region, the minerals and fisheries of which may be as valuable as those of Newfoundland, and their development will not involve us in any international disputes. Flowing into this great inland sea are many large rivers that drain about half of British North America, and a small part of the United States.

The third division, extending from Hudson Strait to the head of Baffin Bay, a distance of about 953 miles, is a region of ice, rock and water, probably of little value except for its whale and seal fisheries; but it is possible that the beds of coal that are found in several places might prove worth mining for whaling steamers, and for the smelting and reduction of the ores of economic minerals.

The fourth division of 955 miles from the head of Baffin Bay to the North Pole is a desolation of perpetual snow and ice, that will probably never be of commercial value until there is an amelioration in the climate.

The officials of the Meteorological Department give the latitude of the Observatory in Queen's Park, Toronto, as 43° 39'.4 North; and longitude as 5h 17 min. 34.65 sec. West of Greenwich.

Assuming the above as correct, the 80th meridian West of Greenwich will be about 30¼ miles west of the Observatory. The above calculation is necessary to fix the meridian, as, for the sake of clearness, (we will assume) the meridians and parallels of latitude are omitted from the latest maps of our Province issued by the Crown Lands Department.

We will now proceed with a description of the country along the 80th meridian.

DIVISION I—SECTION I.

On the banks of Lake Erie in the township of Walpole, County of Haldimand, the 80th meridian first strikes Canadian soil; following this meridian from the southward—the latitude of this point is approximately 42° 48' north—Lake Erie has an elevation of 573 feet above mean sea level.

Running northward this meridian passes Hagarsville Junction, crosses the Grand River in Brant County, between Brantford and Caledonia. Ten miles further on, the Great Western Railway is crossed about a mile east of Capetown, and at the head of the great valley that extends westward from the end of Lake Ontario between the Dundas and Hamilton Mountains so called. The distance to Burlington Bay from this point is about 8 miles, the elevation of the bay being 246 above the sea.

The main line of the Credit Valley division of the Canadian Pacific Railway is crossed near Campbellville Junction. From Lake Erie to beyond the Great Western Railway, the rock formations are overlaid with drift, forming one of the richest agricultural districts of the Province.

Northward from the Canadian Pacific Railway, the country is elevated and broken, the rock of the Guelph and Niagara formations being exposed in ravines in the north part of Halton County and the east part of Wellington County.

The main line of the Grand Trunk Railway is crossed at Acton, 31 miles west of Toronto, northward from which the country continues broken, the meridian crossing the Credit River near the Forks, one of the most picturesque points in the older part of the Province. Clinton and Medina formations are exposed in the gorges of the Credit.

The Owen Sound branch of the Canadian Pacific Railway is crossed a few miles further on, the drift again covering the rock except in the deepest gullies.

Orangeville is passed about three miles to the westward. The height of land between the streams flowing to Georgian Bay and those flowing to Lake Ontario is crossed in the south-east part of the County of Dufferin, where the hills attain an elevation of 1,700 feet above the sea, probably one of the highest parts of the Province.

Approaching the County of Simcoe, the deep valley of the Nottawasaga opens out to the eastward

The Hamilton and North-Western Railway is crossed near Lisle Station, the Northern Railway near Sunnidale, the Nottawasaga crossed only three miles from Georgian Bay and again crossed at its outlet. The meridian now corresponds very closely with the eastern shore of Nottawasaga Bay for 10 miles, crossing the Tiny Peninsula, entering Matchedash Bay, elevation 581 feet above the sea, in latitude 44°02′ north, and 141 miles from the shore of Lake Erie.

This ends the first section.

From Lake Erie to Georgian Bay the country is densely inhabited, this portion of the Province being well supplied with schools, roads, and railways ; and its resources well developed by an intelligent and industrious population All of this section is good farming land, the stratified Silurian rocks being overlaid with drift, with a productive soil.

In the southern portion peaches and grapes are grown, while the apple and the pear are grown in the northern portion.

The northern limit of the blackwalnut and the chestnut is passed near the Grand River and the hickory near Georgian Bay. The white pine has been removed from this area for many years.

By taking the Grand Trunk Railway train at Port Dover, thence by Hamilton & North-Western to Hamilton, Barrie and Penetanguishene the 80th meridian will be closely followed in this section.

DIVISION I—SECTION 2.

Crossing Matchedash Bay between the Giant's Tomb, with its historic ruins two miles to the west, and Prince Wm. Henry Islands to the east, the main land is struck a few miles north of the mouth of the Muskoka River. The Moon River is crossed at its mouth and the town of Parry Sound is passed, lying three miles to the westward.

North of Matchedash Bay the country is altogether different from what it is south of it. The Laurentian district is here entered, a great portion of the country being broken by rock exposures.

The Maganetawan is crossed at a point 200 miles from Lake Erie, and the French River near Lake Nipissing. The western part of this lake is crossed, the meridian running along the east side of McLeod's Bay west of Sturgeon Falls, the north point of which bay is touched by the trans-continental line of the Canadian Pacific Railway.

Lake Nipissing has an elevation of about 660 feet above mean sea level. This beautiful sheet of water has a length of 40 miles and a width of about 10 miles. French River, through which this lake discharges into Georgian Bay, is one of the most marvellous rivers in Canada owing to its numerous channels, its chutes, its cross-channels and its numerous rock-bound mouths.

Northward from Lake Nipissing the 80th meridian crosses the Sturgeon and soon enters unsurveyed territory, passing the southerly outlet of the great Lake Tamagamingue that forms one branch of the Sturgeon and thence along the easterly side of the main lake, crossing several bays, including the long north-east arm. This beautiful lake rivals the Muskoka lakes in size and excels them in beauty.

Passing onward, the Montreal River, a picturesque stream that flows to Lake Temiscamingue, is crossed, the head of which lake lies about 13 miles to the eastward. Temiscamingue has an elevation of about 620 feet above the sea.

The boundary line between the Provinces of Ontario and Quebec runs due north from the north end of the lake, and is about 19 miles distant from the 80th meridian, its longitude being 79° 18′ 58″ west.

Five surveyed townships are passed through on the headwaters of the Blanche River and the height of land crossed in latitude 48° 12′, about 370 miles from Lake Erie and about 215 miles from Matchedash Bay. The height of land has an elevation varying from 900 to 1,800 feet above the sea. This we will call the end of the second section of our line.

The Laurentian region near Georgian Bay is much broken with rock exposures, streams and small lakes. It is sparsely settled by a hardy class of people, who obtain a livelihood from lumbering operations rather than from farming. The hardier grains and all root crops are grown, and immense quantities of pine timber and lumber is still being taken from this area. North of Lake Nipissing, for a short distance, the land is much better suited for agricultural purposes and excellent crops of roots and oats are grown. It is cheaper to import Manitoba flour than to grow wheat, but this is now generally true for all Ontario.

The untenanted wilderness, without roads or paths, except the trails of the aborigines, is entered a few miles north of Lake Nipissing and there is not a white settler between this and James' Bay. Opposite the north-west angle of Lake Temiscamingue, however, it is only a few miles to a settlement.

A few miles south of Lake Tamagamingue the Huronian formation is entered, with its characteristic rocks—rich in minerals requiring capital and brains to develop and make richly remunerative.

Two or three "islands" of Laurentian are crossed in the Huronian area, north-east of Tamagamingue and at the head waters of the Blanche.

Nearly the whole district is overlaid, where there is a soil, with the "Algoma" sands.

Heavy clays are met with around the head of Temiscamingue, there being several townships there in which there are no rock exposures.

The underlying rock at the head of the lake is supposed to be of the Niagara formation, which forms the high, well-defined escarpment that passes around the west end of Lake Ontario from Niagara Falls, thence north-westerly across the Province to Georgian Bay, underlying the County of Bruce and forming the south half of Manitoulin Island. This outlier at the head of Lake Temiscamingue must, therefore, be 160 miles from the nearest Niagara exposure, unless the limestone found on the islands in the east part of Lake Nipissing is Niagara. North-west of Subdury, about 10 miles, is an area of supposed Cambrian rocks covering about 200 square miles.

The area passed through by this second section of the 80th meridian is now being operated over by lumbermen and by mineral explorers. It is not probable that it can ever become an agricultural district.

The northern limits of the Red Cedar and the Butternut are passed near Parry Sound; White Oak, Beech, White Ash and Ironwood near Nipissing, the Basswood south of Tamagamingue, the Hemlock and Red Oak, near the Montreal River, and the Sugar Maple is left behind at the height of land.

South of Nipissing the country can be examined by train from Midland to Barrie, then by Northern to North Bay. North from Nipissing the only route is by canoe up the Sturgeon to Tamagamingue, thence to Temiscamingue, thence up the Blanche, a chain of lakes and connecting rivers a few miles east of and parallel to the boundary line between Ontario and Quebec to Lake Abittibi.

DIVISION 1—SECTION 3.

The third section of the 80th meridian, in the Province of Ontario, commences at the southern edge of the watershed of Hudson's Bay.

The south shore of upper Lake Abittibi is struck 30 miles from the height of land. This lake extends about 30 miles to the east and 3 miles to the west, its width at the point of crossing being 6 miles, the average width being about the same. The upper lake has an elevation of about 850 feet above the sea.

At the eastern end of the upper lake is the Hudson Bay Co.'s post. Lower Abittibi Lake is connected with the upper lake by a river three or four miles in length. The lower lake is not quite so large as the upper lake, from the south-west angle of which the Abittibi River flows south-westerly, the westerly to a point about 25 miles from the lake thence northerly to its junction with its great brothers, the Missinaibi and the Mattagami, the three united forming the Moose River. The Moose River is doubtless the largest river wholly in the Province of Ontario, draining about 27,000 square miles of the Province.

The 80th meridian practically coincides with the eastern shore of the lower Abittibi Lake leaving the vicinity of the lower lake in latitude 49° North at 25 miles from the southerly shore of the upper lake.

From this point to the head of James Bay is practically a terra incognita, a distance of about 145 miles. The shore of James' Bay is struck about 30 miles south-east of the mouth of the Moose River. The country along the meridian is probably very similar to that along the Abittibi River, the highway between Lake Abittibi and James' Bay, the river at no point being more than 65 miles from the 80th meridian.

Huronian rocks are met with about the south-west and north shores of Lake Abittibi and along the river banks for 80 miles below the lakes. Laurentian is also exposed north of the upper lake and east of the lower lake

Areas of Huronian and Laurentian rocks are reported alternating along the Lower Abittibi River, these areas extending to the eastward, the Laurentian predominating.

The northern limits of the Red Pine, the White Pine, and the Yellow Birch are passed in the vicinity of the Abittibi Lakes; the Black Ash and Banskian Pine between the Lakes and James Bay, and the White Cedar at the Bay itself.

The Province of Ontario,therefore, has a length from Lake Erie to James Bay on the 80th meridian of about 570 miles, of which distance 150 miles is an agricultural and manufacturing country densely populated, with its resources well developed.

The southerly 100 miles of the central 220 miles is sparsely settled and partially developed, and the northerly 120 miles,rich in forests and minerals, is unsettled.

The northerly 200 miles is in a state of nature, only partially known to the employees of the Hudson Bay Company, its aboriginal vassals and a few explorers from the Geological Survey Department.

From Toronto to the head of James Bay is about 520 miles, being the same distance as to the city of Quebec, and a less distance than to Port Arthur on Lake Superior. The Province has a frontage of about 150 miles on James Bay, a coast line not yet traversed by a Land Surveyor.

DIVISION 2—SECTION I.

The Second Division includes James Bay and Hudson Bay.

James' Bay is about 150 miles in width, and from its south end to a line joining Cape Henrietta Maria on the west side and Cape Jones on the east side, the distance is about 300 miles.

The 80th meridian passes through James Bay about 50 miles from the east coast, Charlton Island and Solomon's Temples being on the east, and the Twins to the west.

On crossing the 55th parallel of latitude, Hudson Bay itself is entered, Cape Jones being due east.

This may conveniently be called the *Southern* or 1st Section of the 2nd Division.

The shore of James Bay has been fully explored, but there is no reliable map of it published since the British Admiralty map, issued before 1857.

Root crops are grown at all the Hudson Bay Co. ports, also hay and barley, the northern limit of the potato being passed at Cape Jones.

Around the bay the Hudson Bay Co have five posts—Fort Albany, Moose Factory, Rupert's House, East Main Fort and Fort George.

The south and west shores are low, muddy and strewn with boulders, and in places at low tide it is necessary to go beyond sight of the furze-covered land to obtain sufficient depth of water to float a loaded canoe.

Into this bay flow many large rivers in the following order, commencing at the north on the west coast: The Equan, At-tah-wah-piscat, Albany, Moose, Hannah, Nottawa, Rupert's, East Main and Big River. The last is probably the longest, being equal in volume to the Ottawa.

The At-tah-wah-pis cat, Albany and Moose, are navigable for great distances from James Bay by small steamers. The large inflow of fresh water into the bay makes it brackish. The east coast is also low, but the water is deeper than on the west side of the bay.

Devonian rocks underlie the western and southern sides of the bay, but are not exposed along the coast. On the east coast the Laurentian rocks are exposed, and as you proceed northward, the land rises. The northern limits of the Balsam, Fir, and the Canoe Birch are passed near Big River, and the Poplar near Cape Jones. The only remaining trees are the Tamarac, the Spruce, and the Balsam Poplar.

From records kept by the Hudson Bay Co. and observations of explorers, the summer climate of James Bay appears to be about the same as that of the north shore of Lake Superior and of the height of land. The mean winter temperature is colder, but more uniform. The climate increases in severity with the latitude and with the elevation above the sea. In this case the difference in latitude of two degrees is offset by the difference in elevation of over 600 feet. It is generally assumed that an elevation of 1,000 feet corresponds with a decrease of three degrees in temperature.

DIVISION 2—SECTION 2.

The Second Section of this division commences in latitude 55°, opposite Cape Jones.

The 80th meridian passes by the west of the south Belchers and the north Belchers, the latter being opposite Richmond Gulf, a remarkable harbor on the east coast.

Between Cape Jones and Richmond Gulf two large rivers, the Great Whale, in latitude 55° 16′ north, and the Little Whale, in latitude 55° 55′ north, discharge on the east coast.

The narrow entrance to Richmond gulf is 104 miles east of the 80th meridian, this being the most eastern point in Hudson Bay. This gulf is over 20 miles in length and 15 miles in width.

In latitude 56° 48′ the Nastapoka River enters on the east coast, opposite the Baker's Dozen or Committee Islands, just east of our meridian.

Passing northward the coast line approaches the 80th meridian. The south Sleepers Islands are to the west of the meridian in latitude 57° 35′.

Cape Dufferin, in latitude 58° 45′, longitude 79° 10′ west, is the most westerly part of the east coast north of Cape Jones. This prominent point we will make the end of the second section in the second division.

Along the greater part of the east coast there is an elevated ridge forming a chain of narrow islands, between which and the main land is a channel varying from five miles to one mile in width.

Parallel to the coast, and about 100 miles to the westward, is a second chain of islands in groups; the Ottawa group, in latitude 59° 45′ and longitude 80, being the most northern.

Laurentian rocks are exposed all along the coast and in many islands. Between Great Whale River and the Nastapoka, the Laurentian formation is overlaid in many places with dolomitic limestones, and quartzose sandstones of the Devonian all being capped with trap and basalt. The inner chain of islands has a sharp descent towards the main shore, and a very gentle slope to the westward. All these islands appear to be capped with trap.

This part of Hudson Bay has been explored by Dr. Robt. Bell and Mr. A. P. Low of the Geological Survey Department.

A short distance north of Richmond Gulf the northern limit of forest trees is passed, the spruce being the last found. Inland the tree limit runs north-easterly to Ungava Bay.

The northern limit of the otter, the beaver and the black bear corresponds closely with the tree limit. All north of a line joining the outlet of Nastapoka River and the south end of Ungava Bay, may be called barren grounds, corresponding with the north-west side of Hudson Bay, north of Churchill. The reindeer and the wolverine are the only large animals to be found in this district, the musk ox not being found on the east side of Hudson Bay. The Hudson Bay Company has posts at the mouths of the Great Whale and of the Little Whale, the latter being the most northerly post on this coast.

Fort Chimo, on South River, about 30 miles south of the south end of Ungava Bay, is the most northerly post of the Company east of Hudson Bay. It is in latitude 58° 30′ north and longitude 63° 40′ east and about 320 miles east of the shore of Hudson Bay.

DIVISION 2—SECTION 3.

Northward from Cape Dufferin the east coast line bears north-easterly, then nearly north to Mosquito Bay, being fringed with rocky islands similar to the north-east coast of Georgian Bay.

The Ottawa group of islands, in latitude 59° 45′, is crossed by the 80th meridian.

The entrance to Mosquito Bay is about 20 miles in width, the bay itself extending inland more than 50 miles. The north shore of the bay extends westerly to about the same longitude,as Cape Dufferin.

The 80th meridian crosses the easterly part of Mansell Island, the north end of which, in latitude 62° 30′, we will call the end of the second division. Mansell Island is about 70 miles in length and 20 in width.

The east coast north of Cape Dufferin has not been accurately surveyed or thoroughly explored. It is reported to be a desolate, rocky country, probably Laurentian, with scanty vegetation, seldom visited by white men.

The north end of Mansfield Island is nearly opposite to Cape Wolstenholme, the most north-west point on the main land to the east. West from this cape on the outer Digges Islands is Port Laperiere, one of the posts established by the Dominion Government in 1884 for making meterological observations and observing movements of the ice The south-west shore of Hudson Strait extends south-easterly from Cape Wolstenholme, the width varying from 60 miles to 150 miles. From this cape to Cape Chudleigh, which guards the Atlantic entrance to the strait, is about 450 miles. Ungava Bay, with its tides rivalling those in the Bay of Fundy, is a southerly expansion of the easterly part of Hudson Strait, this bay being about as large as Lake Superior. The two observatory stations of Ashe Inlet and Stupart's Bay are situated on the north and south shores of the Hudson Strait, about half way between the Atlantic and Hudson Bay. Port Burwell is near Cape Chudleigh ; in latitude 60° 27′ north and longitude 64° 37′ west.

Cape Farewell, the most southerly point of Greenland, is in latitude 59′ 50° north and longitude 44° west, and is distant about 750 miles from Cape Chudleigh and in almost a due east direction.

DIVISION 3—SECTION I.

Leaving the north end of Mansfield Island, the north-east end of Southampton Island is passed on the left, and Nottingham Island on the east, at the south-east end of which is Port De Boucherville, another Dominion observation station.

The five stations mentioned were established in 1884, and the observers withdrawn in 1886, two winters having been spent in this inhospitable region by our Canadian surveyors and scientists.

Bell's Island lies immediately west of the 80th meridian, a point in latitude 63° 35′ north nearly reaching this meridian. The axis of Chesterfield Inlet, a remarkably long arm, which extends westerly from the north-west side of Hudson Bay, if produced easterly would correspond closely with the south shore of Bell's Island and Southampton Island to the west of it. The east end of Chesterfield Inlet is about 350 miles west of Bell's Island. Southampton Island is about as large as the Province of New Brunswick.

Proceeding northward Fox Channel, one hundred miles in width, is entered, Southampton Island forming the south west shore and Cumberland Island the east shore. Southampton Island is separated from the main land of Melville Peninsula to the north by Frozen Strait and from the mainland to the west by Rowes Welcome. Repulse Bay, at the north-west end of Frozen Strait, is noted as being the wintering place of the explorer Rae in 1846, 1847 and 1853. The distance across the isthmus from the head of Repulse Bay to the south end of Committee Bay is only a few miles. The arctic circle is crossed near the head of Repulse Bay.

For convenience the arctic circle, latitude 66° 32′ north, will be made the end of this First Section in the Third Division. We are now only half way to the North Pole from Lake Erie.

In this Section the large whales are first found, and the musk ox ranges the west shores of Hudson Bay north of Chesterfield Inlet.

DIVISION 3.—SECTION 2.

The arctic circle passes through the narrow part of Davis Strait to the east, the entrance to Baffin Bay and skirts the north coast of the American continent, east of the Copperimine River.

The Fury and Hecla Strait, in latitude 69° 30′, separate the Melville Peninsula from Cockburn Island to the north. The east shore of Fox Channel, north of the arctic circle, does not appear to have been carefully explored, the channel being practically closed to navigation by ice.

Disko, on the east side of Baffin Bay, is in about the same latitude as the eastern entrance to Hecla and Fury Strait and about 650 miles distant in a straight course.

DIVISION 3.—SECTION 3.

From Fury and Hecla Strait to Ponds Inlet, in latitude 72° 30′, a distance of over 200 miles, the channel has not been visited by civilized men and it is only inferred from the movement of the ice that there is a continuous channel. Cockburn Island, which forms the western land, may prove to be two or more islands, but it is probable that the eastern land is continuous with Cumberland Island ; if so, this latter contains an area nearly as large as the Province of Ontario.

DIVISION 3.—SECTION 4.

Pond's Inlet is in the same latitude as Upernivik, the most northerly post occupied by civilized men in Greenland. From the 80th meridian it is about 100 miles to the line of the westerly side of Baffin Bay, and 500 miles to Upernivik.

North of Pond's Inlet the meridian we are following crosses an island about 80 miles in diameter, and enters Lancaster Sound near Cape

Hay in latitude 73° 50′. Passing the eastern entrance to Lancaster Sound, about 100 miles in width, the 80th meridian crosses the easterly end of North Devon, an island as large as the Province of Nova Scotia, then crossing Jones Sound, about 70 miles in width, strikes Cape Tennyson, the most southerly end of Ellesmere Land, in latitude 76° 15′,

Latitude 76° corresponds closely with the north-west end of Baffin Bay, Cape York being in this latitude and 225 miles east of Cape Tennyson. Melville Bay, and its eternal pack of ice, extends east of Cape York about 125 miles.

This section has been thoroughly explored.

Laurentian rocks are found along Pond's Inlet and form the east part of North Devon and the west part of Greenland in the vicinity of Cape York.

Silurian rocks form the land on the south shore of Lancaster Sound and the west part of North Devon.

DIVISION 4.—SECTION I.

We now enter Division Four, this point being practically the extreme northern limit of navigation for whaling vessels and of safe navigation by experienced arctic mariners. The bay which converges uniformly to Smith's Sound is 130 miles in width in latitude 76½° north.

In latitude 78° 15′ north, Smith Sound is only 25 miles in width, Cape Isabella being on the west coast and Cape Alexander on the east. Cape Isabella is in longitude 75° east and 70 miles from the 80th meridian.

Between Cape York and Cape Alexander the east coast is very irregular, Whale Sound and Inglefield Gulf extending inland 60 miles.

Lt. Peary wintered in latitude 77″ 40″ in 1892-93, making this his starting point for his wonderful march north-eastward across Greenland. He has spent two winters in that vicinity since then.

North of Smith Sound, the channel opens out into what was known as Kane's Sea, on the east shore of which is the wonderful Humboldt glacier. To the west a channel extends that may yet prove to divide Ellesmere Land to the south from Grinnel Land to the north. In latitude 80° 15′, the channel again contracts to about 20 miles in width, and is called Kennedy's Channel to Cape Baird where a narrow fiord extends south-westerly for 60 miles and another runs southerly from the opposite shore for about the same distance.

The first is known as Archer Fiord, off the north end of which is Lady Franklin Bay, in latitude 81° 44′, where Greely spent two winters, and where the *Discovery*, with Captain Nares' expedition, wintered in 1875-76.

The southerly bay is known as Petermann or South Fiord.

It should be stated that the average direction of the east shore of Ellesmere Land bears 35 degrees east of north from the vicinity of Cape Tennyson.

Northward from Lady Franklin Bay the channel is known as Robeson Channel which opens into the circumpolar sea in latitude 82° 15′ north.

The *Alert* wintered at the west side of the north entrance to this channel in latitude 82° 27′, longitude 61° 22′ E., in 1875-76 from which point the north coast to the westward was surveyed, also the Greenland coast to the north-eastward.

In 1881-82, Lockwood, of the Greely expedition, extended each of these explorations

The 80th meridian crosses Greely Fiord on the west coast of Ellesmere or Grinnell Land in latitude 80° 45′, from the head of which a chain of lakes and streams extends north-easterly to the head of Archer Fiord.

Hazen Lake is a body of fresh water (or ice) 50 miles long and from 5 to 10 miles wide, lying west of Lady Franklin Bay and 25 miles inland.

The 80th meridian strikes the north shore line of Ellesmere, Grinnell or Grant Land (as it is differently called) in latitude 82° 55′ and about 170 miles from Robeson Channel to the eastward. The westerly half of Ellesmere and Grinnell land is practically unexplored.

Musk oxen, wolves, hares, white bear, ptarmigan and other smaller animals and birds are found in Grinnell Land, and the seal to the north of this land, where large bodies of open water appear.

A small party could probably secure sufficient animal food by hunting to maintain itself in Grinnell Land.

DIVISION 4.—SECTION 2.

This section includes the unknown tract between the north coast of Grinnell Land, in latitude 83°, and the Pole, a total distance of 486 miles ; not so far as from Toronto to James Bay.

Parry, in 1827, succeeded in getting as far north as 82° 45′ by sledges and boats north of Spitzbergen.

Between 1847 and 1857, a great number of arctic expeditions were sent out to rescue the Franklin expedition lost in 1846 after making the North-West passage. These different expeditions explored nearly all of the islands lying west of Baffin Bay and Dr. Kane advanced to Cape Constitution beyond latitude 80° on Kennedy Channel.

In 1860-1 Hayes reported as having gone as far as 82° 35′ by the same route, but it is more than probable that he did not reach this latitude. (*See* Greely's narrative).

Hall, in the *Polaris*, in 1872-73, by the same route, went as far as 82° 15′.

Parry's farthest north, 1827, was not passed until 1875-76 when Nares and Markham pushed through Robeson Channel with the *Alert*, and Markham by sledges went as far as 83° 20′ 36″.

The sister ship, *Discovery*, wintered at Lady Franklin Bay.

In 1881-82 and 1882-83 the Greely expedition wintered in Lady Franklin Bay, Brainard and Lockwood exploring the north-west coast of Greenland to latitude 83° 24′ the "fartherest north" to date, this point being 459 miles from the pole.

Peary in 1893 attained 81° 37′ on the north-east coast of Greenland.

The writer is of opinion that the safest and most certain route to the pole is by vessel to Lady Franklin Bay, thence by sledges over the Poleocrystic Sea, following the Greenland coast as far as possible.

DISCUSSION.

Mr. Chipman—I may explain to you that this map on the wall, which was drawn by Mr. L. B. Stewart, is on a projection which I have never seen described. The centre line is a straight line, representing in this case the 75th meridian. On that, commencing at the pole, were laid off the degrees of latitude; that is, the lengths were computed for each degree from some German table—I believe they were in meters, and reduced to English miles—and put upon this plan which is drawn to a scale of fifty miles to an inch. The total distance between the pole and this parallel of latitude was carefully scaled and the sub divisions made afterwards, so that the errors were not cumulative. The circles are drawn with the pole as centre. Then the length of each degree of longitude was found from tables and the arcs calculated; these were laid off in the different parallel and subdivided. You can understand there was a great amount of work in this. This took Mr. Stewart some two or three weeks before he began plotting on the topography. The topographical part is the least part of the work. When you examine it you will appreciate the excellence of the work. The distortion will be found to be very little. Approaching the pole we found that in laying off the arcs on this circle, the distortion was so small that it amounted to about the width of a line only in a degree, so that it was not apparent to the naked eye. The map extends from the 40th parallel to the pole and then over the pole into Siberia. The object of this plan was to exhibit a strip of territory on each side of this meridian right up to the pole and beyond, all being on the same scale of fifty miles to an inch. The common maps that we have of our country are generally so distorted that they give you a very poor conception of the extent of territory that is north of us. This plan shows the territory from the Labrador peninsula practically to the Lake of the Woods country, and it is the same width throughout. On most maps the great area surrounding the pole is generally shown as being water, whereas it is not known what it is.

The President—I am sure we all feel indebted to Mr. Chipman for the industry which he has expended upon both this paper and the report of the Committee on Polar Research, for I can assure you that so far as I am concerned, although I am on the Committee, I have done nothing towards the work and I think Mr. Chipman has done most of the work himself. He has gone to a great deal of trouble in preparing this paper, and he has given us a great many facts which I think most of us have never given any attention to, and they are certainly interesting.

Mr. Gaviller—I would like to ask as to the coal deposits in the very high latitudes, Baffin's Bay; have you ever found if they are in actual existence?

Mr. Chipman—I have seen photographs of them, that is the best I can say. There is a coal seam at Lady Franklin Bay, about eight feet in thickness above the water level. It is a good quality of lignite, about equal to that in our North-West.

Mr. A. R. Davis—I have travelled a little east and west and south and have always had to pay railway fare--or nearly always--but to-night we have been taken on an excursion to the far north and it has not cost us anything, and it has been very interesting to me. I don't know whether the members of this Association are all crammed full of information about the north or not, but I must admit that I am not very well informed in reference to that country. When my ship comes over, if it has one-tenth of the wealth aboard that I am hoping for, I will gladly equip an expedition to send Mr. Chipman up there. Seriously, I think the members of this committee are worthy of the praise not only of this Association, but of the whole community, for the movement they are making in this direction, awakening an interest in the unexplored regions of our own country to the north. It is hoped that our Governments, both Dominion and Provincial, will in the future take some interest in a financial way in the development of that country; and I am in hopes that this is only the beginning of future researches in that direction.

Mr. Tyrrell—I am sure we were all extremely pleased with the paper we have just listened to; I know I was at all events, and with the report of the Committee also, which I am sorry to have to confess that, though a member of the Committee, I had nothing to do with. There are so many points that I feel like speaking about that I scarcely know where to begin. I might mention a point spoken of in connection with the report as to the expense of an expedition into the north. Mr. Chipman spoke of the necessity of chartering a vessel, but I scarcely think that would be necessary. American and Dundee whalers are in the habit of going as far north as Smith's Sound annually and calling at a point, I think it is called Cape Jones, but not the Cape Jones in Hudson's Bay, of course; it is just to the south-western end of Smith's Sound. An expedition could easily be taken out at a comparatively small cost by one of these whaling vessels; in fact, I happen to know just now of an American expedition which has already made arrangements for conveyance to the shore of Ellesmere Land by a Newfoundland whaler. I think the cost of a small expedition, of say twelve or fifteen men would scarcely amount to any such figure as $50,000. I know this American expedition I have already referred to, which has its headquarters at Washington, is only figuring on $20,000 to $25,000. Whether their estimate is too low or not I don't know.

Mr. C. F. Aylsworth—I must say that heretofore I have never been inspired with a very wild or savage interest in the aims and aspirations of this Association, but after listening to the way in which this subject was handled to-night I must admit I have been endowed with a new interest in it. I think the Association is to be congratulated on having members who are capable of grappling with such a problem as this. I think the fact of this Association taking hold of this subject is going to give it a standing it has not heretofore had.

Mr. Chipman—The object in preparing this paper was to awaken an interest, as I stated, among the members of the Association in our northern land. I believe that there is a great future for that country. We cannot, of course, expect that it will be developed as the southern territory is, but I believe that men can make fortunes there if they will only make up their minds to stand the hardships for a few seasons. It is unreasonable to think that a large territory such as that is a land of desolation, that there is nothing there. That the coal on the north of Hudson's Bay will be available here, of course, is out of the question, but there is a possibility that there is coal south of Hudson's Bay, and while that possibility remains we should not rest until it has been fully explored. I stated in my report that we now know less of that territory than was known two hundred years ago Some may take exception to this statement, but I think it is literally true. As evidence of this, you will find in the corridor outside of this hall a cannon brought here from the north shore of Hudson's Bay. Others were found in the same vicinity, some four I think, and one was brought here. Up to this date we don't know when they were left there or for what purpose. We know nothing whatever about them. And it is so all through that territory, evidences of former visitants are continually being brought to light. Probably the Hudson Bay Company know something of this.

As to a Polar expedition, a great many people laugh at us, but we must just stand their ridicule. If I were only a more robust and younger man I don't think I would rest until I had set my foot beyond the 80th parallel; and I hope that, if any members of this Association at any time have an opportunity of joining in an expedition, they will do so as members of the Association, at least that they will connect the Association with their expedition or with their position in some such way that the Association of Land Surveyors of Ontario will be benefited thereby. It will not detract from the honor that will fall to them and it will be of perhaps great assistance to us.

Mr. Speight—I think the Association would be very glad to hear a few words from Mr. Stuart Jenkins. He is one who has taken quite an interest in that northern country and is here to-night.

The President—We would be very glad indeed to hear him.

Mr. Jenkins—I feel very much honored by the request, but I assure you I came here to-night to learn and not to teach, and Mr. Chipman has so thoroughly exhausted the subject that I don't think there is anything left to say.

Mr. Aylsworth—I would like to hear Mr. Chipman state what he claims to be the object of this expedition. I have been reading a little about the subject lately, and I have been discussing it a little too. Of course I am heartily in favor of it, but I would like to get the real, practical, scientific reason for it.

Mr. Chipman—I think I stated in my report that we will not argue the point with a strict utilitarian. We cannot argue it ; it is out of the question. But for a scientific man I am sure the objects are sufficient. One object is to know what is now unknown ; that is really the great object. There is a tract of territory there that we know practically nothing whatever about, though it has been theorized about for two hundred years.

Mr. Aylsworth—Is that scientific or sentimental ?

Mr. Chipman—Well, it is both.

Mr. Bowman—Are there not certain observations that may be made there that cannot be made other places ?

Mr. Chipman—Yes. Of course, the first thing to be done will be to find a practical route there ; after that, scientific observations will be made. There is no doubt that if the trip be once made it will be repeated. In every difficult work undertaken that has been the rule. Take the scaling of the Matterhorn in Switzerland ; it was not scaled until Whymper did it, but since then it has been done every season, and it will be the same with the North Pole.

There is one other matter I did not touch on. Perhaps you are not aware, as I was not until I thought it over, that probably this Canada of ours contains a larger area of unexplored territory than any other continent in the world. That is something, I think, Canadian surveyors may take home and think about.

BOOKS AND REPORTS CONSULTED IN PREPARATION OF THE PAPER.

Aldrich	Arctic Alaska and Siberia.
Baek	Arctic Land Expedition.
Collinson	Journal of H.M.S. "Enterprise," 1850-55.
DeLong	Voyage of "Jeannette."
Franklin	Journey to Shores Polar Sea, 1819-20.
"	Second Journey to Polar Sea, 1825-27.
Greely	Three Years' Arctic Service,
Hayes	Open Polar Sea.
Heilprin	The Arctic Problem.
Kane	Arctic Explorations.
Koldeway	German Arctic Expedition, 1869-70.
Markham	The Great Frozen Sea.
"	Northward, Ho!
McClintock	Fate of Sir John Franklin Discovered.
McClure	Discovery of North-West Passage.
Melville	The Lena Delta and Greely Relief Expedition.
Nares	Voyage to Polar Sea, 1875-76.
Nordenskiold	Voyage of "Vega."
Payer	New Lands within the Arctic Circle.
Peary	My Arctic Journal.
"	Great White Journey.
Ray	Report International Polar Expedition, Point Barrow.
Richardson	Arctic Searching Expeditions.
Sonntag	Second Grinnell Expedition under Kane.
Wrangell	Expedition to Polar Seas.

Reports of Geological Survey of Canada (Ottawa), 1871-72; 1872-73; 1875-76; 1877-78; 1878-79; 1879-80; 1880-81-82; 1882-83-84; 1885; 1887-1888.

Report of Select Committee House of Commons on Navigation of Hudson's Bay. (Blue Book, Ottawa, 1884.)

Reports on Hudson's Bay Expeditions in 1884, 1885 and 1886. (Reports Department of Marine, Ottawa.)

Report of Select Committee of the Senate on the Mackenzie River Basin. (Blue Book, Ottawa, 1888.)

Report on Basin Moose River (Borron). (Department Crown Lands, Toronto, 1890.)

SUMMARY.

	Sections.	Latitude.	Miles.	——	
First Division.	1	42°48′	000	North shore Lake Erie	Ontario.
	—	44°02′	141	Matchedash Bay	
		44°58′	200	Maganetewan River	
	2		244	C.P.R., Lake Nipissing	
	—	48°12′	373	Height of land	
			400	Abittibi	
	3				
—	—	51°03′	570	South end James Bay	
Second Division.	1	....	700	Solomon's Temple	James Bay.
	—	55°00′	843	Cape Jones	Hudson's Bay.
	2	56°48′	926	Richmond Gulf	
		58°45′	1102	Nastapoka River	
	—	60°00′	1189	Cape Dufferin	
	3				
—	—	62°30′	1362	North End, Mansell Island, Hudson Straits	
Third Division.	1				
	—	66°32′	1643	Arctic Circle	Fox Channel.
	2				
	—	69°30′	1848	Fury and Hecla Strait	
	3				
	—	72°30′	2055	Pond's Inlet	
	4	73°50′	2150	South shore Lancaster Sound	Baffin's Bay.
—	—	76°15′	2315	Cape Tennyson	
Fourth Division.		78°15′	2455	Capes Alexander and Isabella	Grinnell Land.
	1	80°15′	2593	Cape Calhoun	
		80°45′	2645	Greely Fiord	
	—	83°00′	2784	North Shore Polar Sea	
	2	83°24′	2811	Furthest north by Lockwood, 1882	Polar Sea.
		90°00′	3270	Pole	

TABLE OF TEMPERATURES.

PLACE.	LOCATION.	LATITUDE NORTH.	LONGITUDE WEST.	THREE WARMEST MONTHS.			THREE COLDEST MONTHS.			MEAN TEMP. OF YEAR	YEARS.	AUTHORITY.
				Absolute. Max.	Absolute. Min.	Mean.	Absolute. Max.	Absolute. Min.	Mean.			
Toronto	Ontario	43°39′	79°24′W	[1]99.2	28	64	[3]70	[2] − 26.5	+ 24.55	+ 44	1841–94	Meteorological Dep't.
Ottawa	Ontario	45°26′	75°41′ "	99	29	64	55	− 33	+ 15	+ 43	1872–94	" "
Mattawa	Ontario	46°17′	78°42′ "	95	22	63	51	− 43	+ 9	+ 37	1890–94	" "
Quebec	Quebec	46°48′	71°13′ "	96	22	61	49	− 34	+ 14	+ 38	1876–94	" "
White River	Ontario	48°20′	86°20′ "	92	19	55	53	− 70	− 2	+ 31	1887–94	" "
Port Arthur	Ontario	48°27′	89°12′ "	96	21	58	63	− 40	+ 6	+ 35	1877–94	" "
Winnipeg	Manitoba	49°53′	97°07′ "	98	19	61	47	− 46	+ 2	+ 32		" "
Moose Factory	Ontario	51°16′	80°56′ "	94	26	56	53	− 47	+ 3	+ 31	1878–94	[4]H. B. Co.
Prince Albert	Saskatchewan	52°55′	106°0 "	94	14	55	57	− 60	− 1	+ 29	1886–94	"
York Factory	Hudson Bay	57°0	92°26′ "	106	23	53	44	− 53	− 13½	+ 21	1842–83	"
Fort Churchill	Hudson Bay	58°43′	94°10′ "	84	30	45	39	− 45	− 18	+ 14	1885–86	"
Fort Rae	Great Slave Lake	62°39′	115°44′ "	78	28	53	26	− 48	− 24	+ 22	1882–83	H. P. Dawson.
Average Observing Stat'ns	Hudson Strait	63°	75° "	68	27	39	30	− 40	− 16	+ 12	1885–86	Dominion Gov't.
	Bothia Felix	69°59′	92°0 "	......	14	38	....	− 56	− 26	+ 2	1829–32	Jno. Ross.
Point Barrow	Alaska	71°15′	156°35′ "	66	20	36	....	− 52	− 25	+ 9	1881–83	Ray.
Upernivik	W. Greenland	72°45′	55°30′ "	......	....	48	....	− 47	− 7	+ 13		
Port Bowen	Prince Regent Inlet	73°25′	89°0 "	......	23	37	....	− 47	− 27	+ 4	1824–25	Parry.
Bay of Mercy	Banks Land	74°0	118°0 "	......	....	35	....	....	− 6	+ 2	1851–53	R. L. M. McClure.
Sabine Island	East Greenland	74°32	19 "	......	....	..	....	− 41	− 11	....	1869–70	Koldeway.
East of Griffith's Island	Cornwallis Island	74°45′	94 "	......	....	36	....	....	− 9	+ 2½	1850–51	Jno. Ross.
Winter Harbour	Melville Island	74°47′	111 "	......	22	37	....	− 50	− 28	− 1	1819–20	Parry.
North Star Bay	West Greenland	76°34	69 "	......	22	38	....	− 54	− 26	+ 5	1849–50	
	Northumberland Is'd.	77°0	97 "	......	....	31	....	....	− 12	− 1	1852–53	E. Belcher.
	Franz Josef Land	79°51	59 E	......	13	33	....	− 51	− 21	+ 3	1872–74	Payer & Weyprecht.
Discovery Bay	Grinnell Land	81°44′	64°40′W	46	16	33	....	− 71	− 37	− 4¼	1875–76	Nares—*Discovery*.
Fort Conger	Grinnell Land	81°44′	64°45 "	53	....	35	....	− 66	− 39	− 4	1881–83	Greely Expedition.
Floeberg Beach	Grinnell Land	82°27	61°22′ "	50	18	34	....	− 74	− 36	− 3½	1875–76	Nares—*Alert*.

[1] 24/8/54. [2] 10/1/59. [3] 19/3/42. [4] With a break of four years—1885-88.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

THE DAWSON ROUTE.

By W. A. BROWNE,

O. L. S., Toronto.

The Dawson Route derived its name from S. J. Dawson, C.E., who, with a staff of surveyors and Indians, had been employed by the Dominion Government for several years previous to the year 1867 in making surveys and explorations between the head of Lake Superior and the Rocky Mountains to find out the best route to reach the great North-West, and, after spending several summers and winters on the work, reported to the Government that Thunder Bay would be the best point to start the route from, and which was adopted by them, and in the year 1867, the Ontario Government sent a large party in charge of Mr. Bridgeland, P.L S., to Thunder Bay, who commenced exploring, locating and building the road from Thunder Bay (now Port Arthur) to Dog Lake, and built about six miles that summer. In the year 1868 I was employed by the Dominion Government, under S. J. Dawson, in making further surveys and explorations to find out if the line adopted by the Government could not be improved and shortened. I had a party of Indians with me who could speak very little English and I could speak very little Indian, but by making a good many signs I made them understand what I wanted, and we ran a great many lines in different directions, plotted them, and reported to S. J. Dawson, who reported to the Government, and it was decided to change the line from Dog Lake to Shabandawan Lake, and in June, 1869, I was sent up again to Thunder Bay and having engaged a party of half-breeds at Sault Ste. Marie on my way up, as soon as I arrived I made explorations to locate the line between the part built by the Ontario Government and Shabandawan Lake. By the next boat a large party of French Canadians arrived to commence building the road, and another by the next boat, and I had to work my party of sixteen men from daylight till dark to get enough line located to keep them at work. I set them at work building shanties at different points so as to give me time. But after the first month we had an easier time and kept going backwards and forwards between the different parties and so kept them at work. We had four shanties or divisions and built about twenty miles of road that year besides getting out timber for bridges, etc. In the winter of 1869 and 1870 I started with a party of three white men and nine Indians to make a traverse of all the lakes, rivers and creeks on the proposed route, between Shabandawan Lake and Fort Frances, traversing about 500 miles to find out which were the most available, viz., with the longest water stretches and shortest portages. Having travelled about 1,500 miles on snowshoes of course this was a compass traverse, and we did not take all our provisions with us, but *caché* them at several central points (what I mean by *caché* is: we packed down the snow and then put logs and brush on top and put our provisions on and covered them up with oilcloth, bark and brush), and I plotted most of my work as I went along, but, as you can imagine, it was pretty rough work, being done in a shed tent and a toboggan for a drawing table, and sent it down to S. J. Dawson at Ottawa whenever I could, who, after consultation with the Government, decided on the line, and in the year 1870 the Wolseley expedition, to suppress the Riel rebellion, took place, and I was sent word in March by special messenger that the road, water stretches and portages would have to be ready for them and that 1,500 men would arrive on the first boats to assist me. I immediately returned to Thunder Bay and engaged all the men I could and started locating road, pushing up provisions and locating points for the different shanties. I had a party of twenty-five men and it kept us on the jump all the time to get ready for them. We did the best we could, which was not very much, on account of the country being so rough and broken. I saw afterwards many places where it could have been improved if we had had the time. But I divided up the parties and laid out some for one, and went ahead and laid out some for another, and so kept them at work, and when the military arrived we made use of them in construction. The regulars were very anxious to work and kept bothering me to give them work, as we gave them the handsome sum of twenty-five cents a day extra. But the volunteers were not so anxious, but tried to get off. And when I got them all well started, I went ahead and laid out the portages between the different lakes, and built channels in the creeks and rivers by digging out the mud and stones with our hands, wading in the water, and made canals so as to allow the boats to pass. It was no child's play, standing in the water above your knees, and sometimes up to your waist, and digging out mud and stones, and building a wall on each side, forming a regular canal for the boats. The line that was adopted was the Dawson road to Shabandawan Lake, forty-five miles, through that lake and creek dug out as before described, and then portage of about half a mile to Kashaboiawigamok Lake, then portage of about one mile to Lac. Des Mille Lacs, Baril Bay and portage to Baril Lake, nine miles, Brulé portage one quarter of a mile, Windegoostegoon Lake, twelve miles. French River, on which we built canals, by taking the stones out of the bottom and building a wall on each side to allow the flat boats to pass, and in some places building dams to raise the water, so as to overcome rapids. Then French portage, two miles, a very stiff portage, on account of the high and broken solid country, being all rock. Then through French Lake and river to Lake Kagassikok, fifteen miles, to Deux Riviere, portage two miles, Sturgeon Lake, twenty-seven miles, Island portage one-eighth of a mile, Lac La Croix, Tanner's Lake and then Rainy Lake, the longest stretch of water, to

Fort Frances, which was the principal Hudson's Bay post for this district. We met a great many Indians there and had the pleasure of meeting a medicine man, and seeing a white dog feast, which they kept up for three days, and you would think Bedlam had been let loose, what with the tom-toms, dancing and shouting. We joined in some of the dances, much to the amusement of the Indians. The men and women dance separately, but we joined in with the women and had a good time. And then we resumed our journey, making a short portage to avoid the falls (which are very pretty) into Rainy River, and then down the river to Hungry Hall at the mouth, where we were visited by about twenty-five very fine, tall Indians, and we had to be very civil to them, as they all had guns and tomahawks with them and were anything but civil to us. They threatened to rob us, but we gave them some provisions and kept them quiet, so as to give time to a party of about fifty, who were following us, to arrive. I felt anything but comfortable. We had two military men with us, but they took their rifles and went off into the bush and stayed there till the others arrived and then said they had only been off hunting. Then through the Lake of the Woods (120 miles, river and lake) to the north-west angle, and then a waggon road of ninety miles to Fort Garry (now Winnipeg). I have tried to give you a general idea of the route, but being so long ago, I have forgotten a great deal, and especially the Indian names of the lakes.

DISCUSSION.

Mr. Chipman—I would like to ask Mr. Browne to draw on the blackboard a rough sketch showing the forty-ninth paralled, and explain to the Associaton how it was that the American Government claimed that little territory up there called the North-west Angle north of the forty-ninth parallel.

Mr Whitson—At first it was supposed that it was on the forty-ninth parallel.

Mr. Kirkpatrick—Buffalo Bay is about on the forty-ninth. Then you go north quite a piece and then there is a line down, which leaves a tract, I suppose of three or four townships in the States, which has really no access to it. It is north of the forty-ninth parallel.

The President—Is there not a natural boundary there?

Mr. Kirkpatrick—No.

Mr. Chipman—I would like an explanation from some member of the Association how that occurred; how it happens that the United States territory extends north of the forty-ninth paralled.

The President—I think it is somewhat similar to the way Maine and Michigan happened to come into the United States.

Mr. Sewell—I believe that the principle in fixing the boundary was to follow the Hudson Bay water shed, commencing from Pigeon River as the northern boundary of the United States. From thence they were to go to the north-west angle of the Lake of the Woods, and then there were two disputes. One was with regard to Hunter's Island, as to whether the boundary line should go south or north of the Island. That was decided in favor of Canada; and then on a kind of reciprocity basis the "north-west angle" was yielded. From thence to latitude forty-nine, they had to go south.

Mr. Miles—It has always been my impression that it should have read the south-west angle. That there was a "clerical error" made in the draft of the treaty.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

FARMERS' LEVEL AND DRAIN GRADIENT INSTRUMENT.

By ALLAN ROSS DAVIS,

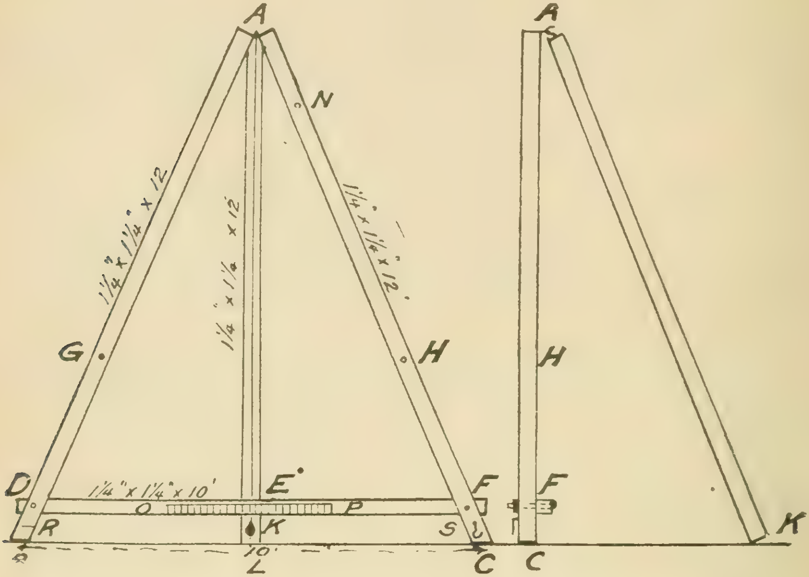
C.E., O.L.S., Napanee.

The farmers of our country have always felt the necessity of some simple contrivance by means of which they could find the difference in elevation of any two points on a drain ; and having obtained the fall to enable them to make the desired excavation on a uniform grade.

I have a distinct recollection of certain discussions with my brothers in years gone by when living on the farm in reference to the direction in which certain fields could best be drained and the probable fall to certain outlet points. Similar difficulties obtain to-day in the management of nearly every farm in the country. Ditches are constructed through every field, main drains, often deep and expensive, are excavated, tile sub-drains are made, road grading and side ditches to the roads continue from year to year on the various road divisions of every municipality, and rarely in such ordinary cases is a level of any sort whatever brought into requisition. If legal proceedings be instituted under the provisions of " The Drainage Act," or " The Ditch and Water Courses Act " an engineer or surveyor is usually employed to take the levels and establish grades. These are the more important drainage projects, however, where several owners, as a rule, are interested, where expensive rock excavations are frequently necessary, and where the drains, extending over several farms, demand careful instrumental work. For all such projects it will be necessary in the future, as in the past, for owners of land to employ engineers or surveyors to perform the work.

For the ordinary drainage purposes of each individual owner of lands, where it is customary to construct ditches or drains "by guess," I have constructed a simple, cheap, light instrument, which cannot get out of adjustment, which does fairly accurate work, and which can be manipulated by any intelligent school boy, who understands simple division, and can see out of at least one eye

While engaged in drainage work in the county of Lennox and Addington last summer, the idea occurred to me that if a plumb line, suspended, would always assume a position in the vertical plane, it should not be a difficult task to obtain a true horizontal plane at right angles to the former. A symmetrical triangle was immediately suggested with a plumb line suspended from the apex. While considerable time has been spent since in obtaining suitable proportions and making various experiments, the simple idea first suggested of a triangle and plumb line still forms the governing principle in this farmer's instrument.



Referring to the accompanying plan Fig. 1 is a front view of the level and Fig. 2 is a side view.

Two white pine legs B A and C A 1¼″ square and 12 feet long are hinged together on the inner side at A. The legs are opened until the distance B C between their extremities is 10 feet, centre to centre.

An arm D F 1¼″ square and 10 feet long is bolted on the legs at a distance of 1 foot from their extremities.

At a convenient height for the eye of, say, 4½ feet from the bottom a small hole is bored part way through each leg at G and H, equally distant from H. A beveled cork is inserted in each of these holes, projecting out, when firm in place about ¼ of an inch.

Fine steel needles are placed in the centre of each cork, perpendicular thereto, projecting beyond the corks about 1 inch. These are the sights and may be made as fine as the eye will allow. Care must be taken to place these sights equally distant from the centre of the hinge H. The hinge rivet has an eye projecting out from each side in one of which—that corresponding with the side of the arm D F, the plumb line is fastened, while a hook at the end of the brace A K, passes through the other eye of the hinge rivet. The lower end of the brace A K is provided with a sharp brad, or grapple, which projects some two inches. A plumb bob is attached to the line so as to swing below the arm D F. The instrument is now erected to the perpendicular, when if the surface B C be level the plumb line will cover the centre part of the arm D F at E. If by reversing the position of B and C. the line covers the point E again, the triangle is true and G and H, two fine sights 7 feet apart are level.

If the instrument be set in this position about equally distant between and in line with two points whose difference of elevation is required, the foot of the brace is brought in until the plumb line swings close to the arm. One leg, B or C, is then raised until the plumb line A K covers the centre of the arm. Then sending a man with a rod, a square piece of white paper and a pencil to one side of the field, the man at the instrument sights over the two needles and directs the assistant in marking his rod at a point in line with the sights. The assistant is now sent to the other end of the drain pacing the distance between the two points.

The same operation is performed there. The difference between the two marks is the difference in elevation of the two points on the ground. Measure this distance in inches, and divide by the distance between drain extremities in hundred feet. If the fall be 20 inches and the length four hundred feet,the grade will be 5 inches per hundred feet.

Having found the fall and the possible grade of the bottom of the drain the more important step of running such grade now becomes neccessary. This is done by means of a graduated brass scale, screwed to the centre of the arm D F. The zero mark of the scale O P is at the centre E and the graduations thereon are made by elevating one leg B $^1/_{10}$ inch at a time, revolving the whole triangle around C, and marking the corresponding points covered by plumb line on the scale for each $^1/_{10}$ inch elevation of B until B is raised 10 inches.

To graduate the left end of the scale C is raised, revolving around B in a similar manner, a mark being made on scale for each $^1/_{10}$ inch elevation of C. The marks on the scale are extended into lines graven deeply in the brass about an inch long and are numbered consecutively from 0 to 100 on each side of centre of scale.

The distance B C being 10 feet, each graduation on the brass scale denotes $^1/_{10}$ inch in 10 feet or 1 inch per 100 feet.

Consequently when one leg is lowered so that the plumb line covers the fifth graduation from the zero mark, the feet B and C stand on the grade of 5 inches per hundred feet, that required for the case in point. Placing B at the lower end of the drain, we raise C until the plumb line covers No. 5, left of zero, B and C are on grade. The point C is preserved and after the section is excavated, the grade of another section is obtained by placing B on the point C, and again making plumb line correspond with No. 5. Thus each section is excavated if shovels be used. Should plows and scrapers be utilized, a more convenient way would be to make the excavation for a considerable distance approximately and then run grades over the bottom of the drain by setting up instrument in centre of field and elevating one leg until plumb line denotes the required grade on scale. There the needle sights being on grade make the bottom of drain parallel to the line of sight over needles Thus the instrument will not require moving until drain is completed. When the leg B is raised to the highest point. viz., 10 inches, the base is not 10 feet and therefore theoretically the grade would not be $^1/_{10}$″ for 10′. Practically, however, it does not appreciably affect the scale since the inclination to the horizontal is but 29 minutes and the length of the base is 9.999644 feet.

I have made several tests of the work done by one of these farmer's levels made by myself, not as carefully as may be done, and found the work to correspond very closely with that done by my level. I am convinced that when due care is exercised in their construction that levels sufficiently accurate for distances of about 200 or 300 feet on either side of the centre, may be taken, and the grades run with but little variations from the true grade. The County Council at its last session in Napanee adjourned one afternoon for a time to witness the operation of the level and expressed hearty approval of its simplicity, cheapness and necessity. When not in use the bolt D is withdrawn and the arm swung around until the bolt is placed through the leg at N. B and C are then drawn together and secured by a hook and eye, R. and S. The sights are removed and in a compact shape the level may be laid away.

The feet B and C are covered with a thin sheet iron plate to preserve them from abrasion.

DISCUSSION.

The President—It appears to me that this instrument will not interfere in the slightest degree with the engineer, as some might be inclined to think. We should remember that anything that we may do that will lead to the benefit of the farmer will benefit every man in the country. We, to a certain extent, depend upon the farmers for our living, very largely so in fact. And I think that if you can help the farmer to dig his small ditches he will not attempt anything larger. Of course if he were to undertake to carry out larger works, the inevitable result would be that the farmer would bungle the job and would throw away Mr. Davis' level in utter disgust and go and consult an engineer. In that way it seems to me it might do the farmer much good, and if it does it benefits us. It certainly cannot do us any harm.

Mr. Sankey—I quite agree with the remarks just made. I think that there is another point, though, that is probably worth considering. I have not myself had a great deal of experience amongst farmers in this country as to drainage, but before I came to Canada, I had a good deal of experience in that way—I refer now to the North of Ireland—and it was generally found that some farmer had a rough and ready way of draining, and the farmers in his neighborhood, when they saw that he got a good result from what he did, would get him to do it for them on their own farms. Then the result of all this draining was that they accumulated so much water in the water courses outside that larger works had to be undertaken in order to carry off the water. Now I am not down on the Ontario farmer at all : he is a good, shrewd, hard-working man, and does not mind spending money if he can be sure that he will get a return for it. When he drains one field and sees the result he will go to another, and perhaps his neighbor will take up a field or two, and so on, thus making themselves better able to bear the assessments that will come on them for a large draining scheme. I understand from information lately received through a friend here in Toronto that there are a great many more thousands of acres in Ontario susceptible of drainage than even the surveyors know anything about, and I hope that some member, who is conversant with drainage matters will write a paper on that subject for next year, with any statistics he may be able to get during the year to show the enormous number of acres lying idle and useless in this province to-day for want of drainage. In the North-west they have been making some surveys for irrigation work in the neighborhood of Calgary, and it has astonished even the engineers themselves to find the large amount of land that is brought within the limits of a supply of water. I think the same thing would apply in the reverse direction here, that is we would be astonished to find the great number of acres that could be drained with comparatively small cost. The instrument seems to me to be a suitable and handy instrument. I was going to ask whether there was any means of elevating or depressing the legs ?

Mr. Davis—There could be an extension leg.

The President—I think it would be just as well to confine it to the simple form. I am thinking of putting this into the hands of a farmer in some work I have to do to guide him in laying his tile drains. It is somewhat similar to the English boning rod.

Mr. Fawcett—I have seen ditches of some ten miles or more laid out with an instrument like that in British Columbia. It is used by Chinese and others for constructing ditches for irrigation purposes. They generally go along and just move the front leg of the instrument until they get the grade they want. In using an instrument like that they get their ditches constructed in a very good shape, so that the principle seems to have been already adopted out there.

Mr. Gibson—I suppose I am the only farmer present, and it strikes me as being important to know in the first place what the cost of the machine is.

Mr. Davis—It need not cost more than $3.

Mr. Gibson—Well, it is within the means of "us farmers" anyway. You are probably aware that there are men who make it a business, almost a profession, throughout the county of York, to do drainage work, and there is always a little trouble about getting their levels. Now this instrument is one that cannot get out of adjustment and can be handled by anybody, the hired man or the roughest man you can get hold of Not only that, but it would encourage men to drain their lands and get rich, so I think it is a very excellent idea. I am much pleased with the machine.

Mr. Robertson—Up in our section of the country, where crude methods of farming are carried on very extensively in the shape of draining, the open drains are usually constructed first. The farmers do a great deal of tile draining, and, as Mr. Gibson says, there are tile drainers who do a great part of the work. A great many of the farmers, however, get an engineer to take the levels first, then they get this professional tile drainer to come on, and they have an instrument—I have not seen any like this, but this would answer the purpose very well—and they come on with it and complete their work with the stakes set by the engineer. In that way the drainage is chiefly carried on up there. Of course there are some who put in their drains without any instrument whatever, but in many cases they might as well bury their money as their tile in that way.

Mr. Ross—I think it would be to the advantage of the Engineer to have this generally adopted, because a man working with this would carry out his work in a good manner. The open drains would have an even grade and the water would run nice and smooth, and the engineer would get the credit ; people would say he knows his business. There was a discussion on that matter last year in reference to a case where the tiles were very improperly laid, and the engineer got the blame for it, but with this, {all work of that kind would be properly done.

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THE ANEROID.

By OTTO J. KLOTZ,

O.L.S., D.T.S., Ottawa.

In the following notes no attempt will be made to give any theoretical exposition of the theory of barometers—mercurial and aneroid—but simply to give results obtained in the field, compiled from observations by members of the Staff of the Alaska Boundary Commission, 1893-1894.

The object of the Alaskan survey was for the purpose of obtaining the topography of the country. For this end the photographic method was used. The triangulation necessary for orienting the photographs was made with 3-inch Troughton & Sims transits, reading to minutes in both horizontal and vertical circles. The trigonometric height of mountains was obtained with this instrument also. Each party was supplied, too, with several aneroid barometers, for convenience of knowing by simple inspection the approximate altitude. The final altitudes of all points, however, rest on the trigonometric determinations and those obtained from the photographs based thereon.

The aneroids were by H. Hughes & Son, London, and were of three sizes—2″, 3″ and 3½″; the first two had an attached thermometer, and the smallest a movable footscale. The 3-inch ones were found to be the best. Systematic and simultaneous readings of the aneroid, at camp and on mountain, including those of temperature, were not made by all the parties. In the following results, of course, only such were utilized. Nearly all the mountains were climbed directly from the sea; and the ascent and descent were made mostly in one day. The altitudes climbed range from 2,000 feet to 6,000 ft.

Mr. Edward Whymper, the noted traveller, has made elaborate experiments with the aneroid, and from his investigations has arrived at certain conclusions, among which may be mentioned:—

1. That at low pressures (high altitudes) the aneroid is very unreliable; the difference of readings of mercurial and aneroid may amount to two inches.
2. That difference of height at low pressure may be obtained with considerable accuracy.
3. That from aneroid readings, mountain heights are almost invariably too great.
4. That the difference of level obtained in ascending is generally greater than in descending a mountain.
5. That all aneroids, without exception, lose upon the mercurial barometer when submitted to diminished pressure, and recover a portion of the previous loss when pressure is restored.

6. That index errors are seldom or never constant.

7. That the method of examination of aneroids at Kew Observatory is faulty, and the deduced corrections for various pressures (30 to 15 inches) incorrect.

These conclusions cover a wider ground than the experience in Alaska afforded ; however, some of the foregoing conclusions have been corroborated.

The most marked is—That aneroids almost invariably lose upon arrival at the summit of a mountain, that is when the aneroid is read on reaching the summit, then again after several hours (after taking the angular measurements and photographs) it will show a diminution of pressure, that is an apparent greater altitude. This difference of reading, for a range of about 6,000 ft. of altitude, fluctuates between 0 and 5 hundredths of an inch, or say from 0 to 57 feet. From this observed fact it becomes evident, that if an aneroid and mercurial be placed under an air pump, and within a short space of time (an hour or so, as is customary) comparisons be made at various pressures, the results are erroneous for application in the field. The aneroid has constitutional properties and peculiarities, and even idiosyncrasies, the latter being a measure of our ignorance.

From comparisons which I made in 1893 and 1894 of the same aneroids, with a standard mercurial, I find that the index corrections are not constant. However, it is not essential that, for obtaining altitudes by difference of barometer readings (foot and summit) the index corrections be known, for unless it be large, the ratio of the uncorrected readings will practically equal that of the corrected ones. For example: Suppose the readings to be 30.15 in., and 24.72 in., indicating an altitude of over 5,000 feet, the index correction be +.05, the difference between the two deduced altitudes is less than 10 feet.

With reference to the difference of level obtained in ascending and descending a mountain, the Alaskan observations of 1893-1894, on 43 mountains, give the following results :—

Altitudes deduced without applying temperature correction—29 were greater from readings of ascent than of descent, the difference aggregating 1772 feet ; 12 were less from readings of ascent than of descent, the difference aggregating 600 feet ; 2 were equal from readings of ascent and descent.

When the temperature correction is applied, and this correction is a very important one, and should be well observed, that is the temperature of the atmosphere, and *not* by means of the attached thermometer which some aneroids carry, but a thermometer swung in the air, then it was found that 21 were greater from readings of ascent than of descent, the difference aggregating 1239 feet ; and 22 were less from readings of ascent than of descent, the difference aggregating 1316 feet.

From the latter, which are of course the ones to be utilized, it would appear that the probability of the altitude deduced from readings of ascent being greater than that of descent, is equal to the probability of being less.

Furthermore, the mean difference is ± 60 feet.

Mr. Whymper's experience that, from aneroid readings, mountain heights are almost invariably too great, the Alaska observations give the following results :—

HEIGHT.		DIFF.	HEIGHT.		DIFF.	HEIGHT.		DIFF.
Mean of Aneroid.	Trigonometric.	A – T	Mean of Aneroid.	Trigonometric.	A – T	Mean of Aneroid.	Trigonometric.	A – T
ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
1796	1781	+15	3827	3893	– 66	4558	4719	–161
2412	2478	–66	3886	4026	–140	4702	4774	– 72
2457	2470	–13	3901	4052	–151	4710	4812	–102
2930	2971	–41	3942	4072	–130	4764	4836	– 72
3009	3059	–50	3967	3983	– 16	4773	4766	+ 7
3134	3173	–39	3967	4070	–103	4842	4982	–140
3258	3322	–64	4063	4092	– 29	4847	4881	– 34
3353	3340	+13	4065	4098	– 33	5009	5175	–166
3380	3452	–72	4108	4156	– 48	5097	5159	– 62
3427	3493	–66	4182	4220	– 38	5137	5268	–131
3479	3557	–78	4185	4209	– 24	5390	5533	–143
3654	3670	–16	4219	4233	– 14	5731	5917	–186
3748	3684	+64	4357	4440	– 83	5748	5913	–165
3766	3850	–84	4399	4492	– 93	5802	5913	–111
3774	3851	–77	4470	4483	– 13			

It will be seen in the 44 comparisons of aneroid (mean of ascent and descent), and trigonometric height, only four show a greater height by the barometer, and the difference only averages 25 feet, whereas 39 show a marked less height. From the 44 comparisons we obtain a mean difference of 70 feet for a mean height of 4,200 feet. That is, the barometric height is too small, and is in error somewhat less than 2 per cent.

This is contrary to Mr. Whymper's observations; but it must not be forgotten that his results are obtained, I think, exclusively from very high altitudes in the Andes, and hence not strictly comparable, as the loss of the aneroid on the mercurial is not a direct function of the height.

Johnson, in his valuable "Theory and Practice of Surveying," says (p. 136) :—" * * * to stop at a number of stations during the day for a half hour or so, reading the barometer on arrival and on leaving. The difference of these two readings shows the rate of change of barometric readings due to changing atmospheric conditions, and from these isolated rates of change a continuous correction curve can be constructed on profile or cross-section paper, from which the instrumental corrections can be taken for any hour in the day."

From the experience gained in Alaska, as also that of Mr. Whymper already referred to, the above conclusion appears faulty, for if while stopping at a station ascending a mountain the atmospheric conditions be constant, then we would experience a fall of the aneroid, indicating apparently a change in the atmospheric conditions. This has been noted time and again where one barometer was read hourly at camp and another one read on ascending and descending mountains. From the former we could see the change in the atmospheric pressure.

The formula used for the determination of heights by the barometer was

$$Z = \log \frac{h}{H} \; 60384.3 \left(1 + \frac{t + t' - 64^\circ \text{ F.}}{900} \right)$$

In the use of the aneroid for determining difference of altitude, it is very essential that the temperature of the air at top and bottom of mountain be carefully read, not for the purpose of making any correction to the barometer readings, for the change of temperature alone of the air does not affect the barometer, at least not that at sea level, but for the purpose of correcting the constant, by which $\log \frac{h}{H}$ is multiplied. This constant represents the height of a column of air of uniform density, and at a temperature of 32° F. Consequently, when the mean temperature is greater than 32° F. the volume of air becomes greater, the density less, and the height consequently increased. The correction for temperature has, in some instances, amounted to over 300 feet.

Conclusion. Read the barometer carefully at ascent and descent; hold in same position, preferably horizontal; note by a good thermometer (not attached to aneroid) the temperature of the air, and the mean of the deduced altitude will give a very fair, say within two per cent., value of the difference of height, or absolute height if one station is at sea level.

Among the data obtained are some from which an approximate value of the relation between temperature of the atmosphere and altitude may be obtained. The thermometer readings were not taken with this end in view. This relation varies with the condition of the atmosphere, the most potent factor being that of humidity. As is well known, one of the manifestations of solar energy on the north-west coast of the American continent is the reception of humid thermal currents—the Japan current—from the south-west, whereby the climatic conditions, due to latitude, are greatly ameliorated. The drier the atmosphere, the greater is the difference of temperature in ascending or descending a mountain. The greater the humidity of the air, the less is the difference of temperature dependent on elevation ; this is due to the latent heat given out by precipitation of the moisture. This property of the atmosphere makes itself apparent in our Chinook winds along the Rocky Mountains, and in the Foehn of Switzerland. To illustrate : Suppose a moist, warm current from the Pacific to strike the Cordilleran range of mountains in British Columbia. Let its temperature be 60° F., and the rate of cooling be 1° F. for every 350 feet of height ; suppose it to be carried to a height of

7,000 feet, its temperature will then be reduced to 40° F. Precipitation will have taken place, and the latent heat of the water given out. The current proceeds onward, eastward, and descends to a valley of say 1,600 feet elevation; that is, it descends 5,400 feet, but now as a comparatively dry atmosphere, and for which the rate of cooling due to elevation is 1° F. for about 180 feet difference of altitude. We would then have the current warmed 30° F., and this added to its temperature when beginning the descent would give us a "Chinook" with a temperature of 70° F. This is an ideal case, but the principle involved is the one that explains the Chinook and Foehn.

The result arrived at, that is the equivalent in altitude for a difference in temperature of 1° F., is obtained from 21 determinations, ascent and descent of mountains. Due to difference in the humidity of the atmosphere and other causes (unknown), there is a considerable range for the value of altitude, due to change of 1° F. in the temperature. The minimum value obtained was 141 feet, and the maximum 863. The arithmetic mean of all gave 376 feet ± 25 feet.

Jordan gives the mean value for Middle Europe as 365 feet.

Bauernfeind in his investigations has found that the temperature of the air decreases in arithmetical ratio with the increase of altitude, and is proportional to the sixth root of the barometric pressure, the temperature being reckoned from the absolute zero.

DISCUSSION.

The President.—The last experience I had with an aneroid was when it brought out a hill about 300 feet high which I was on, below the swamp I started from.

Mr. Chipman.—We used the aneroid this summer on some work between here and Georgian Bay, and excepting on windy days we found the results quite satisfactory. On a windy day we did not rely on it at all.

Mr. W. F. King—What was the difference in height?

Mr. Chipman—I suppose you mean the difference between the extreme elevations measured. The error did not generally exceed five feet in a distance of one mile, the difference in elevation being 200 feet.

Mr. King—This table that Mr. Klotz gives shows that there is a good deal of irregularity in the results with the aneroid. The average is about 2 per cent., but there are many cases in which the error runs a great deal over that. I am inclined to think that if the observations were analyzed it would be found that the average error increases with the height. I think in measuring small heights, as Mr. Chipman says, you will get pretty close results, but when you run up to a certain point the aneroid seems to fail. I have noticed that myself in a small way in many years. I have made exploratory surveys on prairie where the differences of level were not very great, and used the aneroid and found it gave me very good results generally, that is, I would measure a hill and the result would come pretty near what I would guess it to be. I did not find any case where the top of the hill was lower than the bottom. In one case I was driving to the Cypress Hills, where the ground rises gradually for a long distance,something like 40 or 50 miles, and I took careful aneroid readings all the way. We occasionally dropped into a deep valley of probably 150 feet, and it would record all right. The ground kept rising and rising until I got up to an elevation very nearly 4,000 feet above the sea, 3,500 anyway, that is a difference of perhaps 1,500 feet between that and the level of the prairie at the point I began the readings from, and so far it had recorded everything apparently right. Then I dropped into a valley of about 300 feet, and it showed that 300 feet, the depth of the valley, a great deal less than what it evidently was. Then we got from that up a steep hill on to the plateau of the Cypress Hills, about 4,000 feet, and the barometer absolutely failed to work ; it showed the top of that hill to be at the same level as the creek below. I see in the first part of the paper, giving Mr. Whymper's results, he says (No. 4) "that the difference of level obtained in ascending is generally greater than in descending a mountain." Then these aneroids seem not to be tested or made accurate beyond a certain point, and if you get up near that point your aneroid is ruined by being strained. I remember on the old boundary survey of the 49th parallel, somebody taking an aneroid barometer up a mountain, and when it got up 4,000 or 5,000 feet above the sea the thing stopped, althought the maker had graduated it to show a height of something like 12,000 feet I may say in defence of the Alaska survey, that, though you may think these are wild results given in this table, the accuracy of the survey is not involved in these aneroid readings. It is merely an auxiliary reading used principally as a check upon the other work, and is taken out as an alternative instrument in case the triangulation work should fail. Two years ago when we started the Alaska survey, we knew nothing practically as to the climate of Alaska except that it was very wet and very cloudy, and we thought it would be impossible, perhaps, to apply the triangulation system with photographs, so we took aneroids and a lot of other rough instruments, for the sake of having something in case we could not get any photographs. But these aneroid readings do not enter into the results at all ; the results are made complete by the very full survey we succeeded in making by means of the transit and camera.

Mr. Lumsden—I have done a good deal with the aneroid and I cannot say much for it.

Mr. Sankey—Is it found that the aneroid on returning from a high station returns to its normal condition and will register afterwards, or is it likely to be out of adjustment ?

Mr. King—Well, it is likely to be out of adjustment, they say. We had about 12 or 15 aneroids on the survey, and half a dozen of these had to be returned for repairs. They seemed to work loose and got out of kilter. I don't know whether it was the extreme moisture that caused it, or the difference in level.

Mr. Chipman—Did you carry a mercurial barometer for checking it ?

Mr. King—Yes, which was always kept at the sea level.

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TRIANGULATION WORK ON TOPOGRAPHICAL SURVEYS.

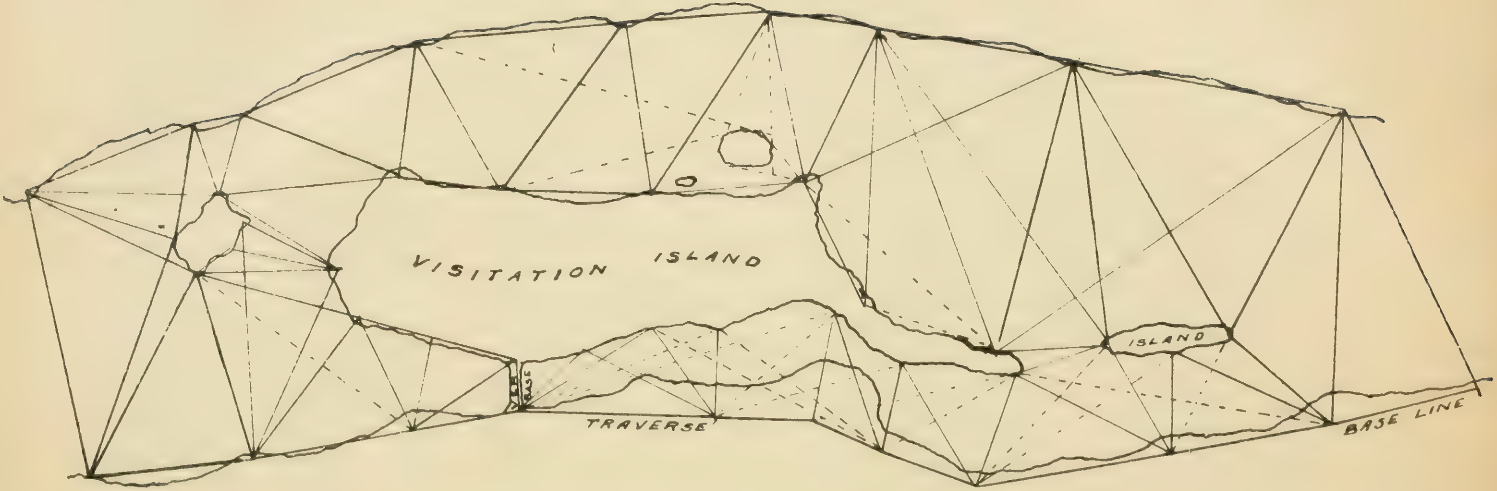
By HENRY K. WICKSTEED,

O.L.S., Cobourg, Ont.

In the circular of the society dated Dec. 24th, among the subjects suggested for discussion is that of the above title, and the writer having frequently had recourse to the system under somewhat unusual conditions thinks that a few remarks may be of some value. He has found the method of peculiar value in the case of surveys of broad rivers, with thickly wooded banks, where the traversing of both banks would entail a large amount of chopping through tangled under brush, and consequently a strong party of axemen. By the triangulation method, a base being established, the chain can be done up and the survey can be carried on by the surveyor and assistant with two men and two canoes, at a rate much in excess of traversing, and varying from 2 to 4 linear miles per day according to the lengths of the sides of triangles, and the amount of detail desired.

It has always been the writer's practice in such surveys to mark the station points by a pole cut in the woods, and having two cross bars fastened to it at right angles to one another, so that from whatever distance it is looked at it always appears as a cross. When the angles are to be read the pole is lifted out of its hole, and the instrument set immediately over it. Plumbing over a hole 2 inches in diameter in a mud or gravel bank may not appear to be a very accurate method of proceeding, but it will be found that in ordinary work with an instrument reading to minutes the probable errors are very much less than it is within the power of such an instrument to detect and record.

A few months ago, upon a railway survey, the writer had occasion to run a traverse along the shores of a couple of long river-like lakes in order to block out a location, following them as closely as possible. Being very shorthanded and the country covered with wind falls and scrub the average progress had been only about one mile per day. He conceived the idea of triangulating, with the result that the rate of progress was doubled and one-third of the party were employed running supplies forward without any loss to the working party. The average length of side was 700 or 800 feet, and the result was of considerably greater use in determining the location than a traverse would have been. The area covered by this survey was some three square miles and the cost $60.00, or $20.00 per square mile, including only the rough plotting necessary for camp work. The only conditions necessary in



Skeleton Plan of Triangulation

H. K. Wickstead, O.L.S.

choosing the station points were that at least three points, two behind and one in front, should be visible from it and that the subtended angles should not be less than 30° or more than 120°. All these angles of each triangle were invariably measured and the sum was expected to lie between the limits of 179°58′ and 180°02′, the angles being laid down on the paper with an ordinary protractor. Any less error was not considered worth looking up, but it was very seldom that the sum did not come within one minute of 180°. Another survey, of which a plot is given, was made of a portion of the Ottawa river. The area comprised was something less than one square mile, but the amount of detail was considerable. The measurements were carried over a traverse eastward for one mile or more along a side channel of the river with a number of subsidiary triangles in order to determine the widths at different points. The last line on this traverse was used as a base from which a chain of main triangles was carried westward up the main river for two miles and then back along the side channel to the first line of the traverse as a verification base. The resultant error was less than $^1/_{10}$ of 1 per cent. and was probably due to the imperfect chaining of a raw hand employed. The entire cost was $20.00, and the time occupied two days. Only one assistant and, for a portion of the time, one laborer were employed. The ground on each side of the traverse was elaborately levelled and contoured necessitating a chained line of some sort as a basis for cross sections, otherwise a chain of triangles throughout would have been equally serviceable, and more rapidly measured. The writer believes it to be customary in such surveys to mark the two ends of the base line by permanent stone monuments which can be readily picked up at some future time in case it is required to extend or check or amplify the survey. Stone monuments are expensive things, iron bars are not quite proof against being stolen or moved, and the writer has found that the location from the base line of two or more existing permanent objects and the determination trigonometrically of their distance from one another (and bearing) answers every purpose, and that these objects need not necessarily be accessible. In the case under discussion a church spire and the iron stack of a mill formed two convenient points of reference by which to tie on any future work in the neighborhood. The writer believes that a survey of this kind, where correctness without any extreme precision are all that is required, as in filling in between the angular points of a precise triangulation, or in the case of a survey of a limited area for a special purpose, can be carried on with very much greater rapidity and cheapness than in any other way. As each triangle is complete in itself and is proved as the work proceeds, the surveyor is freed from the constant dread of errors due to careless chainmen and picketmen, which the writer, for one, always feels when running a long traverse to a closure.

DISCUSSION.

Mr. Gaviller—There is one point mentioned in this paper, the cost of triangulation, which has been inquired about, but this only covered a very small area. I think it would be hardly proper to base the cost of a large triangulation upon the figures given here. Still, it is a very good paper, a practical paper, and one that I think would apply on the triangulation here, because it was mentioned by Mr. King that where the principle triangulation would take place in Ontario is level country, and being such, there are not very many prominent elevations to locate as permanent points and the lines would be consequently much shorter than they would be in a more hilly country.

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CO-EFFICIENT OF REFRACTION.

By OTTO J. KLOTZ,

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As a good many reciprocal zenith distance readings between mountain summits were taken in Alaska last season by Canadian members of the staff of the Alaska Boundary Commission, for the purpose of obtaining the heights of the mountains, it was thought that the data might furnish, too, an approximate value of the co-efficient of refraction. It must be remembered that the instruments used were 3-in. transits—Troughton & Simms—and reading to minutes on both circles Hence the degree of precision is not comparable with that of primary triangulation. However, it will furnish a comparison to those engaged in similar work and under similar conditions. It is well known that the humidity of the atmosphere in Alaska is high. The mean temperature was about 56° F. for the season.

In the theoretical investigation for refraction the path of a ray is supposed to be concave towards the earth. Observation shows that this is not always the case. Simultaneous observations between two stations are made under the assumption that then the path of a ray is a circular arc, while if not so made—that is at different times—the circular arcs will probably be of different curvature, and the correction for refraction at each station not equal. By co-efficient of refraction is understood the ratio of the correction for refraction, to the angle at the centre of the earth, subtended by the distance between the stations, or, more accurately, to the angle between the normals.

For an exhaustive treatment of the subject the reader is referred to Helmert's "Hoehere Geodaesie."

If z = observed zenith distance at one station.
z' = " " " " other "
dz = refraction correction to z.
dz' = " " " z'.
m = co-efficient of refraction.
C = angle at centre of earth subtended by distance between two stations,

Then, $z + dz + z' + dz' - \pi = C$
Assuming $dz = dz' = F$
Therefore, if $z + z' > \pi$
$\therefore$ $C - 2F$ is positive (C is always positive).
$\therefore$ either $2F$ is positive and $< C$.
Or, $2F$ is negative and $>< C$.

If $z + z' < \pi$

$\therefore$ $C - 2F$ is negative.

$\therefore$ $2F$ is positive and $> C$, and hence m positive.

The co-efficient $m = \frac{F}{C}$ will be positive for all positive values of F.

2F, *i.e.* F, can only have a negative value when $z + z' > \pi$, and hence m negative only for same condition.

We find, therefore, that when m is negative that the path of the ray is convex towards the earth.

When $z + z' < \pi$ we infer a compound curve—convex and concave—for the path of the ray.

An astronomer once said to me in Washington, "Results alone should not be published, but always accompanied by the observations, so that the reader can draw his own inferences." This is very true, but this is essentially an age of "time is money," and most men say with *Boz*, "What we want is facts;" how they were obtained is to them immaterial. There is a limit however to "boiling down." Even if all details are not given, yet, in a "paper" presented to a society of professional men, enough of the method, instruments and conditions should be stated, that a fair estimate can be obtained by the reader of the value of the results given

I may state that in compiling the reciprocal observations only two observations were discarded, and these showed palpably errors of sighting to the wrong peak in the reciprocal reading. By discarding largely divergent values, of course, the probable error of the resulting mean could have been materially reduced. The observations have all been reduced for an assumed uniform height of instrument.

From the subjoined observations we find the mean value of m to be .0793 ± .009. The value of $m = .078$ for the sea horizon is given by Lee as determined by the U. S. Coast and the Geodetic Survey in the New England States.

From the mean of 144 values of m determined from the observations of the Ordnance Survey, it appears that the mean co-efficient of refraction is .0771. The co-efficient is somewhat greater (about 10%) for rays crossing the sea. From Jordan's "Handbuch der praktischen Geometrie," we quote the following:—

Extreme values of *m*.

Delambre finds—

Maximum $m = .2977$.

Minimum $m = .-0035$.

Geodetic Survey, East Prussia—

Maximum $m = .0769$.

Minimum $m = .0632$.

Precise levelling, Swinemünde and Berlin—

Maximum $m = .1334$.

With calm air and pleasant temperature.

Minimum $m = .0415$.

With strong winds and low temperature.

Gauss gives—

Maximum $m = .1039$
Minimum $m = . - 0571$.

Coast Survey of Baeyer has—

Maximum $m = .1938$.
Minimum $m = .0478$.

Fuss, Sawitsch and Sabler found, in the determination of the differences of level between the Caspian and Black Sea, even greater deviations, which, however, from the shortness of the distance, may be attributed to errors of observation.

The observed zenith distance is dependent upon the pressure, and hence variable. Temperature, too, affects the observed angle of elevation or depression ; in short, the co-efficient of refraction is a function of the temperature and atmospheric pressure.

The angle of depression, irrespective of refraction, should always be numerically greater than the angle of elevation. There are instances (as we had) where two stations whose difference of level is not great, and distance apart considerable, mutually show angles of depression, but never both of elevation.

For a simple approximate rule, and one easily remembered, may be given :—" One seventh the number of thousand feet between two stations gives the difference in minutes of the reciprocal readings."

From this we know at a glance whether there is anything abnormal or any bulk error in the readings.

To determine the height of a mountain with a fair approximation to the truth is, with proper instruments and care, not a difficult matter, but to obtain accuracy within a few feet for high mountains is, from the nature of the problem in its present state, impossible.

COMPUTED VALUES OF M FROM RECIPROCAL ZENITH DISTANCE READINGS, NOT SIMULTANEOUS, WHERE $m = \frac{F}{C}$.

Distance.	m.	Distance.	m.	Distance.	m.	Distance.	m.
FT.		FT.		FT.		FT.	
22903	.0342	43572	.0245	70640	.0040	102051	.1478
26420	.0615	45079	− .0593	70651	.1331	103636	.1667
26905	.0729	45885	.2190	74961	.1761	108238	.1116
28340	− .0587	47580	.0386	75769	.0590	124076	.0882
31614	− .0873	54631	.1236	84025	.0506	124930	.0794
31839	.0626	57433	.0705	87155	.0493	126925	.2414
36032	.1223	61351	.0268	89856	.0809	142990	.1115
38983	.1977	63612	.1387	93195	.0465		
42395	− .0273	64270	.0715	94792	.1184		

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REMARKS ON THE CRADLE THEODOLITE.

By JOSEPH M. O. CROMWELL,
O.L.S., Perth, Ont.

I have observed that the only figure of an English-made surveying instrument appearing in the annuals of the Association, is that of a cradle theodolite, and I am aware that a number of those instruments have long been and are yet in use, for all purposes, among our practitioners, and, while appropriate papers have appeared in the annuals relating to the transit theodolite, I have observed nothing relating to the cradle. I propose, as briefly as I can, to supply what appears to me to be requisite, mostly with reference to that instrument. I may, incidentally, refer to the English transit in passing.

The English cradle theodolite, especially the five inch, is a handy, portable instrument, sufficient for almost any work in surveying in the settled portions of this country. and for sub-dividing in original surveys, if in as exact adjustment as its construction admits, but, as supplied by the makers and vendors to the profession, it is not, so far as my experience goes, adapted for astronomical work at all. I speak whereof I know, in saying that more erroneous astronomical bearings have been recorded in Canada, owing to its use than from all other causes. How is it that, although most, not all, of its individual parts are well made, and the graduations equal to those of other instruments, material parts are so attached to each other, as to render it, for astronomical purposes, worthless ?

The principal objections to those instruments are, that the standards, as usually made, admit of no adjustment for leveling the vertical axis, and they are seldom of equal height. I never found them so ; and the Y's are screwed or otherwise so fastened on the Y plate without any attention as to whether they carry the optical centre of the telescope or line of sight, at right angles to the vertical axis, also the time and patience necessary to rectify those displacements.

I will, at the risk of taking up too much space, give an illustration or two, I could give many, by some results flowing from the use of those instruments in their usual form. In 1853 I was sent for to establish side-lines in two concessions in the vicinity of Ottawa, reputed to be 100 chains in depth, each, and, as there had been conflicting surveys in the two concessions, to save what was believed to be unnecessary costs, and end contentions, I was informed it had been mutually agreed to run the lines on the astronomical bearings of the governing boundaries, then lately ascertained by a very reputable surveyor who was leaving the profession for more remunerative employment (then only $4.00 per diem), which I declined to do, and took the bearings myself, using an eight inch English transit with two telescopes and illuminating axis and a mercurial false horizon. Both governing lines were well defined throughout, and we differed in our recorded bearings in both concessions, 0° 17′ 0″, and 0° 22′ 25″, respectively, both in the same direction. He informed me he had taken his observations on polaris at its greatest elongations, with a false horizon, at two places on each concession, and we both came to the conclusion that the most likely cause of the difference was, that he used a cradle theodolite, whose line of sight was, probably, not at right angles with the vertical axis, something that had not previously occurred to him. Where a farm survey of his came in contact with one of mine, the difference on the ground was very much less than the difference between our recorded bearings, *i.e.*, the cradle, under similar circumstances, gave approximately similar results.

In 1858, for the two townships, I made a survey of the town line between Nepean and March, extending the depth of four concessions, in Nepean, from the Ottawa river. It had previously been surveyed under instructions from the C. L. Department, and stone monuments planted on the original line where it intersected the concession lines by another surveyor who used a cradle theodolite. With my transit and a false horizon, I took the astronomical bearings of three of the four of the governing boundaries on it of Nepean. Afterwards I ran side-lines in those Nepean concessions, fronting on the Ottawa, one of which resulted in a costly law-suit, and the plaintiffs' attorney procured copies of the field-notes of the surveyor who placed the stone boundaries on the town line, which stones represented the front and rear ends of the lines governing the courses of the side-lines in Nepean, when, to our horror, it was discovered that his sworn astronomical bearings differed from mine 3° 27′ 00″ on the concession in question, 3° 37′ and 4° 02′ 7½″, respectively, on the other two concessions. The differences were all the same way. Under these circumstances they deemed it advisable to employ another surveyor to take the bearing of the boundary in question, to test mine, which was done. He used a fine Troughton & Simm's cradle theodolite, with two telescopes and a false horizon, and took his observation on the greatest elongation of Polaris, and we differed in our bearings about 0° 7′ 00″, which was the nearest coincidence between the transit, in adjustment, and the cradle, as it came from the maker I had known, and was sufficient for our purpose. I suggested to the old gentleman, that, as he had not tested his instrument, which was nearly new, for that emergency, it was possible that the collimation of his instrument, owing to displacement of the Y's, might possibly be a little off, and, if so, it would describe a curve, and not a perpendicular straight line in passing from the star to its reflected image, and he enjoyed a hearty laugh at my expense, remarking, that "boys might be expected to give vent to nonsense like that."

The adjustment of those instruments is a tedious process, occupying several days. In unfavorable weather I have spent a week or more, at one. I have felt something akin to the old elder who always went to prayer before commencing to put up stove pipes. The first requisite is to adjust the collimation in the optical centre of the telescope. If the tubes are not accurately fitted to each other, the inner one will not travel in a straight line, and every movement of it is liable to change the collimation, and, in that event, the adjustments of the other parts become more difficult—it is something that cannot be remedied, and is hardly less objectionable than eccentricity, and is too frequently found in other classes of instruments as well as in this one.

The next thing is to make the vertical axis permanently level, which can best be done by the aid of an observation on polaris, which gives a perfectly vertical line of indefinite length. The instrument being accurately leveled by the levels, and made to cut the star, the deviation from cutting its reflected image in the false horizon will indicate which of the standards is to be raised (the bearings of those instruments which are champered cannot be lowered), thin slips of brass or copper are to be placed under the feet of the shortest standard,—they may be got from cartridge shells with very little alteration,—which is then replaced and fastened by its screws, and the operation repeated till the spider line cuts the star and its image. As the ends of the vertical axis of those instruments are not cylindrical, care must be taken in replacing the standard that the tops are the exact width of the axis, or chafing will result.

There are two sources of error in collimation peculiar to the instrument in question, viz., that of the lines in the telescope, and that of the Ys. I have already referred to the former, the latter is the most important, as already shown.

It is evident that if the collimation or line of sight is not at right angles to the axis on which it revolves, a small, and not a great circle of the sphere, will be described on its surface, and if the telescope is elevated and depressed on a horizontal axis (not a perpendicular straight line), but a curve will be described on a perpendicular plane surface, at right angles to the line of sight, the convex side of which curve will be opposed to the inclination of the line of sight. In other words, if the error in collimation be to the right, the error on an observation will be to the left, and *vice versa*.

TO ADJUST THE Y^s FOR COLLIMATION.

As the telescope cannot be revolved on its axis as on the transit, I have found the following to be the easiest method, viz: Hang from the gable of a building of at least two stories, the higher the better, as fine a plumb line as can be distinctly seen with the telescope, and of a different color from the building, to which fasten at about on a level with the telescope when the instrument is in position, a small block of wood with a card tacked on it at the back of the line, the block to be just sufficient to let the card touch the line when taut, and when the twist is out and the line at rest, secure the exact place of the line by a perpendicular pen and ink mark on the card, set the instrument at right angles from the building and opposite the line sufficiently distant to bisect with the spiders lines, the top of the plumb line at an altitude of from 40 to 45 degrees, level the instrument in the usual way, and adjust the focus for distinct vision of the line. About half way from the card to the top of the line, place a false horizon in position to show the reflected image of the top of the line, and with the leveling screws, make the spiders lines bisect the line at top and its image in the horizon, and its deviation on the card will be the error in collimation, resulting from displacement of the Y's. And the operation must be repeated by detaching one of the Y's and removing it sideways on the Y plate and re-fastening it so as to throw the line of sight to the right, if the error, as shown on the card, was to the left, and *vice versa*.

After the telescope is focused for short distance, it should again be examined for collimation so that the Y may not be moved owing to a mistake as to where the error in collimation lies.

The tubes of a surveying or engineering instrument ought to be as truly fitted to each other as the spindle is to the cone, otherwise the object glass will not travel in a straight line, and every movement of it is liable to change the collimation, causing endless loss of time and worry and vexation, especially in inclement weather or amid a horde of mosquitoes.

It is an advantage peculiar to this instrument, that, as there are no attachments to the telescope it can be reversed in the Y's for transiting with little or no need of disturbance of the instrument, but it can be more easily and safely done if the telescope is given more room to pass in and out of the Y's, which can readily be done by filing something off the heels of the clips to enable them to turn back, and moving that one of the Y's a little lengthwise on the Y plate, which may have to be moved for collimation, so that the flanges of the telescope will not necessarily impinge on the Y's. The collars being segments of one and the same cylinder there can be no objection to giving them sufficient play room on the Y's. I prefer the English cradle to the English transit for the production of straight lines.

Many years ago, in London, I remonstrated with a leading optician against sending out those instruments in the state I have indicated, his answer was, " it is not intended for astronomical work." That being so, it should, for Canadian surveyors, be either " mended or ended."

I may add a few remarks intended to relate to the English transit.

I know of no reason why Y, instead of circular bearings are made for the telescope to revolve in, except for reversing the axis in the Y's, nor is there any reason for reversing the axis at all, except to avoid the error so often found in collimation, and even if the collimation is all right, another difficulty is climbing in the Y's, and what I have found to be the best and easiest way to avoid that, in so far as it can be avoided, is to soft solder plates of brass on the under sides of the ends of the clips so as to raise them sufficiently to admit a small slice of firm leather fastened with two small screws with deep threads, coming in from above and having two milled thumb-screws on each clip, instead of one milled and one common screw, by which to give the clips just sufficient pressure to secure the axis firmly without impeding it, and without a screw-driver. Also, if the shoulders of the axis fit close to the Y's, as they usually do, it will be difficult to reverse it in the Y's without disturbing the instrument, which may be largely prevented by extending the distance between the Y's just sufficient to let the axis pass in without grazing. As I have stated in reference to the cradle, it can be done by loosening the screws under the feet of one of the standards just enough to admit thin, narrow slips of brass, to be inserted under the inside edges of its feet, a very little lateral play to the cylindrical bearings can do no harm. My work has been all local, and I have always, on comparatively level ground, produced my lines with a pocket telescope and plumb-line, as I could in that way be up with my men and make better headway, with quite as much accuracy as in using the transit. I preferred reversing the axis in the Y's unless the collimation was exact. It requires considerable practice to picket correctly and rapidly with the pocket telescope. In transiting, I left the attachments of the telescope at home to facilitate reversing it in the Y's.

My practice of over forty-eight years, has all been local, almost exclusively astronomical. I never went on government surveys. I have preferred the five inch English transit (it comes cheaper here than the best foreign instruments), with perforated axis, and axis level reading to 20". I have discarded the English case and re-paçked it in a longer, narrower case, about two-thirds of the cubical dimensions of the English case, with the telescope attached, which makes a much safer and more portable case. I have taken my astronomical observations on polaris, at nearly all hours of the night, when the stars could be seen—on the greatest elongation, when early in the evening—otherwise, on it in conjunction with any one of the other principal circum-polar stars. Sometimes, when I had surveys in several localities, miles apart, I took the observations at them all the same night, to avoid stopping over for a clear sky at either place. My eyes have not, for many years, been sufficient for day observations. The perforated axis is much to be preferred; it affords a constant, steady light, so desirable in hazy weather or floating clouds, and avoids the aberration caused by the flickering of a light held by an assistant, in windy weather. It is especially preferable when two stars are being used in conjunction with each other, as nearly as possible at the same instant of time. Also, the axis level, if properly constructed with vertical and lateral adjustments, is to be preferred to the false horizon, as it gives less trouble, and it is hardly possible to have the mercury packed in the case without particles of it getting on to the graduations, and it requires a rather dangerous heat to evaporate it. As the axis of the cradle theodolite is not made to receive a level, the horizon is the only alternative, in astronomical observations, but there is no reason why its bearings should not be cylindrical and extended beyond the Y's to receive a level, except that it would be leaving the old rut of the makers.

In conclusion, it is not so vital the kind or size of the instrument, as the perfect adjustments of every part of them. An exceedingly small defect in the tripod or graduations, or the exact placing of the verniers, etc., etc., will more than counterbalance any advantage to be gained by a larger or differently constructed instrument. For example, I have had several instruments, in every other respect faultless, in which one or both of the verniers were a very little too near or too distant from the centre of the vernier plate, so that, although their zero lines were exactly opposite to each other, or 180° apart, on the vernier plate there was less or more error in the readings from them as they were taken from some division on the vernier less or more remote from its zero end. I have frequently had to detach a faulty vernier and replace it so that its lines at both ends would exactly coincide with the two divisions on the limb it was intended to embrace. Twenty or thirty seconds of error, resulting from the foregoing defect alone, would make all the difference in the results between a six inch instrument reading to 20″ and a five inch reading to a minute.

DISCUSSION.

Mr. Abrey—There are a good many errors in this paper, as printed, that perhaps ought to be corrected before it goes in the report. When he says "false horizon," I suppose he means an artificial one; he even uses the word "vertical" where he means "cross" or "horizontal." And by "levelling the vertical axis," I suppose he means adjusting them. There are a good many errors like that all the way through.

In reference to the adjustments for placing the "Y's" at right angles to the cross axis, it is not always made so that that is easily effected. I got a transit made some time ago and I had the telescope made to revolve through Y's so as to give a chance of placing the collimation in the centre of the telescope. Then it became necessary to place the axis of the telescope at right angles to the cross axis and I got the Y's placed with adjusting screws so that that might be done. It was for the purpose of solar observations I got it made, and there are some advantages in having it revolve in that way as well as to revolve on standards.

I must say I am surprised at the amount of error he found in taking observations, "three or four degrees." I presume that the cause of error was simply because the telescope was not at right angles to the cross axis; there seems no other reason for it, and such a large amount is most surprising. Then, in taking astronomical observations, as he refers to here, of course there ought to be a pair of observations made. The north star is so elevated it becomes necessary to always correct the error of the level of the cross axis so that in all cases I think that the observations should be made with a striding level.

In reference to what he says about producing lines with the theodolite, I think perhaps he is correct, that in careless or hurried work the theodolite produces lines better than the transit; it is less liable to get far astray. It does not matter much whether it is adjusted or not if the ground be comparatively level.

Mr. Gaviller—Another difficulty is a little ice getting on the Y's and swinging it off to one side.

Mr. Aylsworth—Do you suppose frost would affect the Y's ?

Mr. Abrey—It should not.

Mr. Aylsworth—One cold morning, when I struck out to run a line with my transit, I took hold of the end of the telescope and it seemed to move in the Y's. I just put in a little piece of paper for that day, but I never saw it move that way afterwards.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

HIGHWAY BRIDGES.

By PETER S. GIBSON,

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When the capital invested in these structures as well as the necessity of them is considered, we may well express surprise that more skilled and professional attention is not given to them.

1. At an early period of the settlement of our country, before our timber lands were cleared off and our swamp lands overrun by fire, our rivers and streams required very simple structures for bridging them, whereas at present, with our drainage systems and clearing up of our forests, high, violent and sudden floods are the rule.

My practice in constructing bridges in about 1858 on the Government Colonization Roads was to build King and Queen Post Trusses from 40 to 120 feet spans in the clear. The long spans were necessitated to facilitate the running of logs in the valley of the Ottawa River.

In the western part of Ontario short spans only were required, which for want of saw-mills were nearly all constructed of hewn timber, the plank alone being sawn lumber, and that, in some cases, whip-sawed at site of bridge.

The prices for such bridges were usually about, for hewn timber, 10 cts. per lineal foot; sawn lumber, about ten to fifteen dollars per thousand; board measure, iron from about 10 to 20 cts. per lb; stone in cribs, about $1.50 per cubic yard—all to be furnished by the contractor, and paid for at these prices complete in the work. The price of the iron seems very large, but the transportation to site of bridge added materially to cost.

2. The sub-structure of these bridges was usually of timber piers and abutments connected by double dovetail joints, and pinned at angles with white oak or rock elm pins. Sometimes the piers required to be sunk in water from 10 to 20 feet in depth, and were sunk by filling in with stone in false bottoms of thin boards, which were broken through by the stone filling, which was not only intended to add weight to the piers; but, in case of the foundation or bed of river being uneven, or foundation of piers being undermined by currents in the river, the stone filling, usually of round boulders, would run from the piers into any holes about the base, and thus form a good foundation.

I have known of bridges having similar piers sunk in deep water, but with a timber bottom, which could not be broken, nor was intended to be broken by the filling in of stone. These bridges very soon failed on account of the foundations of the piers being washed out.

3. In about the year 1867 I commenced building highway bridges in the County of York, where there were plenty of saw-mills and lumber reasonably cheap, so cheap that plank roads about up to that time were constructed in many places.

I found the old bridges which I was called upon to rebuild usually King and Queen Post Trusses. The main braces, straining beams, chords, joists, and needle-beams, all of heavy timber, from 10 inch to 12 inch, and 12 inch to 14 inch sections. These bridges did not usually last over 12 to 14 years.

These bridges had sub-structures, piers and abutments of heavy timber, or bents of similar timber, which did not usually last as long as the superstructure. Some of the bridges had masonry piers and abutments with poor foundations.

4. After examining these structures I recommended the councils to adopt a different system in building the bridges. To have the superstructures composed of built beams, the main braces, straining beams, chord timbers, needle beams, to be of two pieces for short spans. up to 66 feet, to be bolted together with oak blocks between, 3 inches thick, and joints lined with sheets of galvanized iron, and that heavy joists should not be used.

5. I also recommended that cribs of timber should not be constructed either for piers or abutments—not only on account of the liability to rot, but on account of the cost—but that pile piers and pile bents should be constructed for sub-structures, and especially that the old fashion abutments, whether of timber or stone, should not be constructed, but that an additional short span or spans should be built, as much less expensive, and also to give additional water-way for the sudden high floods, loaded with all kinds of rubbish and timber, which often blocked the water-ways and caused a new bed to form for the river.

6. Another recommendation was, that the superstructures should not be bolted to or built into the piers or bents, as in case of a jam of timber and rubbish forming at the bridge it would be much better to have the superstructure carried away readily with the floating materials than resist it till by its great weight it would either crush through the bridge or cut around and form a new bed.

It may seem strange to make provision for such cases, but not when it is borne in mind that for about the last 25 years there has been a gradual abandonment of water-power, and that it has been the regular thing for the mill dams to be carried away with the spring freshets, carrying timber, trees, and large blocks of ice and other materials, which no river-bed would accommodate.

I found that such bridges readily separated into their component parts and usually lodged near the site of the bridge, and that no very great expense was required to replace the superstructures on the piled substructure, which usually was not much damaged.

7. I found that such bridges could be cheaply built as the timbers were light, and so easily handled, and also required very little skilled labour, as the chord timbers were made up of short pieces, secured together with iron straps or plates and bolts, and no tenons or mortices were allowed in the structure.

8. I also suggested that painting of new bridges should not be done until the woodwork was well seasoned, as the combination of fixed and volatile oils of linseed and turpentine, with metallic salts and oxides and other materials, usually formed a crust or coating, that prevented the woodwork from properly seasoning, and thus produced a dry rot. I also objected to the use of coal tar, and similar substances often applied to woodwork before it is seasoned, especially when applied to heavy or large timber.

I have found that good paints are hard to get, and that even the best, when exposed to the weather, requires renewing in three years or less, and as bridge timbers are not always dressed for painting—and should not be painted without it—that the dressing and painting is quite an expense, and, also, as wood-work requires protection to keep from checking while seasoning.

9. I have adopted the plan of covering all the upper surfaces of the important members of the superstructure, including the needle-beams and sometimes the joists, with galvanized sheet-iron, which I specify shall have the sheets neatly lapped upon each other and extend down the sides not less than half an inch, and to be secured to to the timber and each other with flat-headed wire nails, all to be done in a neat and workmanlike manner so as to protect the timber from the wet. This, with the above-mentioned lining of all large joints, is a much better plan and less expense than painting or sheeting in the trusses with some thousands of feet of inch boards, and also presents a neat and finished appearance to the structure, and gives facility to inspection and repairs if necessary, and tightening as the structure gets seasoned or may require.

10. I also provide that the railing shall be so constructed that the parts shall have snow-boards to keep the winds from blowing the snow off the roadway of bridge in the winter, as when bare in sleighing time the teaming is very hard on the structure.

11. I have the planking of bridge so arranged that there shall be a space between the ends of the plank so no filth or dirt shall run upon the chord timbers. If the roadway is to have 14 or 16 feet plank I have the space between chords made four inches wider and have alternate plank abutted on opposite sides against the chord timbers, thus leaving a two inch space on opposite sides for the slush to run off.

12. I find that bridges constructed as above-mentioned last a long time, and that the joints lined with the galvanized sheet-iron protects them, so that in bridges with joints so lined when taken apart after being constructed over 12 years or more, show the ends clear and white as just after being cut with the saw or chisel.

I have now many bridges which have been built over 16 years and show very little signs of decay.

13. Of late years I have found considerable trouble in securing a good quality of pine lumber, lumber merchants being anxious to include in the bill as much Norway pine and top lumber as possible. In one case, when constructing an iron bridge over 350 feet in length and about 90 feet high, I had to condemn a large part of the bill of lumber and have it removed from the site on account of Norway pine which had been shipped. This class of pine does not answer for bridges whether cut thin or thick, and does not last over 10 years, and, if heavy timber, less. Lumber cut from the tops of trees is very objectionable, as it may be said to be nearly all sap wood. It looks neat and clean and sound, and has small knots but soon decays, and should not be used in bridge works.

14. In building wooden bridges I prepare a plan, specifications, bill of materials and estimate of lumber, etc., and cost, and guarantee to the contractors who tender for the work that the bill of quantities of wood and iron, etc., is correct, and fix a price for each which will be paid for extra materials, if ordered. The contractors can thus prepare lump tenders with very little trouble, as they know that the lumber, iron, cedar and stone can be bought and put into the work all complete at about $22.00 per thousand, board measure, for lumber, and cedar piles at about 25 to 30 cents per lineal foot, and iron bars, or spike and nails at about five cents per pound, and stone filling for piers at about $12.00 per quarry toise. With such facilities for tendering, the tenders are often very close to each other, and on account of the simplicity of construction tenders are often very low.

15. Of late years all long spans of important bridges are built of iron and steel on masonry abutments and piers, but for ordinary country roads, wooden bridges with spans up to 60 feet in the clear, are preferable when constructed as above mentioned. In case of steel and iron bridges, whether constructed with pin, screw or rivet connections, they have a fine appearance, and it is a pleasure for an engineer to construct them, and if properly cared for, may be said to be permanent structures. But especially in case of the rivet connections, these bridges do not receive the attention as to cleaning and painting, etc., they should. The idea seems to be that when an iron bridge is built it requires no care. I know now large iron bridges which I may say are actually " rotting down," as they have not been re-painted for many years and the rust now hangs in scales from them. They are all thin plates connected with rivets. I am afraid these bridges will not have long lives.

16. In 1878 I had a large number of highway bridges to build, and with a view to economy I decided to take tenders for iron as well as wood. In one case the main span was to be 60 feet in the clear, and, as I do not build abutments at ends, but short approaches, I had one 20 foot approach at north end and two short spans, 20 feet each, at south end. I received a tender for the main 60 feet span, the superstructure only, for the sum of about $1,000, to be of iron trusses, etc., and for the whole wooden bridge, including two heavy pile piers and pile bents for short spans, $800. So I concluded to build the

wooden bridge, which has now been standing about 16 years and has had very little repair except re-planking, and only presents the appearance of being well seasoned.

17. I had intended entering into the consideration of the relative cost of bridges of wood and iron under the various circumstances and conditions in which they may or have been built, but find it would extend this paper to an objectionable length.

DISCUSSION.

The President—This is a very important subject to the county engineer, and I am sure it will be of considerable value to most of the members. In determining the area of waterway for bridges, a very good rule—I think it was announced by Mr. Myers some years ago—is to take the square root of the number of acres in the watershed and consider that the number of square feet for area and multiply by from two to four, depending upon the character of the soil. If it is agricultural soil, two is all right, but if it is a flat rocky area, four gives about the right figure. I have followed this rule for some years, and in no case have I had any structure flooded. He very properly points out that dove-tail joints for piers are a thing of the past. It is a mistake; it adds very greatly to the cost of putting up a pier and it is not as strong as a crib built in log-cabin fashion. I have tested them practically with a dredge, trying to tear one of these piers apart and I found I could not do it. As to the oak blocks, I would like to ask whether oak blocks placed in connection with pine do not produce mutual rot between them?

Mr. Gibson—No, because I line them with galvanized iron.

The President—Then about paints; for iron work there is no question about red lead paint stirred up with linseed oil being best. It is necessary, though, to keep one man stirring while one man is painting. In dealing with ordinary white lead, we asked some Montreal dealers recently to submit samples and prices of the best white lead paints. After we received them, each one of which was of course the very best white lead, guaranteed commercially pure, we submitted them to a simple little test with a blow pipe to see how much metallic lead was in each sample of paint. One proved itself to be nothing more or less than baryta there was not any lead in it at all. That is the paint that all the painters in that part of the country liked. If it were good lead it would settle to the bottom, and therefore they didn't like it. In the second, we could find some minute particles of lead scattered through the baryta, and the one that the painters condemned absolutely was pure lead. So that a simple test like that, taking only about fifteen minutes with a blow pipe, will determine whether you are getting white lead or whether you are getting baryta.

The only other point I would like to touch upon is whether concrete sub-structures cannot be used more largely than they have been. All through this northern region, where there are extensive drift deposits, there are numerous gravel beds which could certainly be had very cheaply. During the past year I constructed myself about 400 or 500 yards of concrete piers, using one mason only to see that it was properly mixed and rammed. It cost us $5 75 per cubic yard in place. Some of it required excavation under water ; that included foundations, cribbing and everything complete, and not only that, but the piers were of a peculiar form to cut the water, not unlike a plowshare. I took some trouble to get that shape, for in these places it is a fight between the strength of the ice and the strength of the masonry. I saw a test made a short time since of a block of ice 12 x 16 inches, and it required 120,000 pounds to crush it, so since seeing that test I have had more respecr for the strength of ice than I ever had before.

Mr. Gibson—In building bridges I make point of pier curved and nearly vertical, and the ice passes around it. If point of pier is made sharp and sloped the ice slides off the point and breaks off the masonry by catching in the joints, and is likely to lodge in the pier. " Ice breakers " for points of piers do not often break the ice.

The President—In regard to the comparative cost of wood and iron, during the past year the Indian reserve down at Tyendenaga were about to build a bridge across a creek, and they wanted to build a wooden one. I prepared a plan for what I believed to be a good wooden bridge for the cost, but they were not satisfied. Then Mr. W. R. Aylsworth, of Belleville, thought of the fact that you can buy iron beams delivered to-day, rolled beams up to 20 and 24 inches in depth, weighing 80 pounds to the lineal foot, suitable for spans of 40 feet, for $1.75. The result was that iron came very much cheaper than wood. He stayed them up very simply and cheaply, and put on a plank floor of cedar, and in that case the iron beams were quite a considerable saving on the cost.

Mr. Gibson—The great trouble we have with bridges in the County of York is that we are so near the lake the floods are very high and the ice jams and sweeps the bridges away, unless you go to great expense in putting up very heavy piers and abutments and very high bridges.

Mr. Davis—I have had some experience in the line of bridge building, though not very expensive, but I find there are very many points touched upon by Mr. Gibson in this paper that will be valuable in the future. The necessity seems to be as great to-day as ever for this smaller class of bridge all through the country, and the old ones are tumbling down. I find threshing machines are making sad havoc among the bridges in our county. A short time ago, when I came to take the measurements of a bridge, I found a farm engine keeled over and the bridge in a general state of demoralization. But we put up a bridge there that we are quite satisfied no steam engine will break down in future.

Mr. Ellis—I would like to ask whether you have had any experience with concrete bridges altogether, anything in regard to the cost of these ?

The President—No, not yet. I think if you take pure concrete I have no doubt whatever that they can be built at a cost not exceeding $7 per cubic yard. That is for arches.

Mr. Ellis—It has always been a surprise to me that it has not been adopted before in this country. It is the only material that improves as it grows older. Wood deteriorates, whereas concrete improves, and I believe that they can be built quite as cheaply as iron bridges. Of course, you would have to use a certain amount of iron in the structure.

The President—That would be adopting the " Melan " system that they are now pushing very strongly in the United States and Germany. Mr. Ransome has published a very interesting book in which he describes how he puts his rods of iron into some machine and twists them into spiral form and then puts them in so that the concrete grips the iron and you get the benefit of the iron upon the tension side of the arch. There it adds to the cost of the concrete, but compared to the iron it is more permanent no doubt.

Mr. Gibson—In the case of iron bridges adjoining Toronto, long and high structures, built upon the rivetted system, we find that the rust is attacking them fearfully.

The President—It is due to bad painting.

Mr. Gibson—Yes, but the trouble is to get good paint. Lead is the only thing you should use, but they use iron oxide, and that is actually plastering rust on the bridge to start with.

A Member—I would like to ask Mr. Gibson what he generally uses for flooring.

Mr. Gibson—White pine ; I find Norway pine will not last more than five or six years ; it is no use at all.

Mr. De Gursé—I had occasion to look into the matter in connection with the Michigan Central Railway bridge in the city of Windsor. They proposed putting in two thicknesses, the first three inches of white pine, and placing upon that three inches of oak. I suggested that they put in cedar in the bottom and use white oak instead of black or red, as they were intending to do. They adopted my suggestion very readily, and I imagine that would be one of the very best floors, because white oak will resist the wear well.

Mr. Gibson—The trouble is you can't get it here very readily. I have a bridge now that has to be re-planked about 300 or 400 feet ; it was constructed with two-inch plank in the bottom and three inch on top, and it is a mass of rottenness. I think they better put on a four-inch single plank if they want thickness.

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GOOD STREETS.

By HERBERT J. BOWMAN,

Town Engineer, Berlin, Ont.

A GREAT movement has arisen during the past few years for "Good Roads." It is the purpose of the writer in this paper to touch upon the kindred question of "Good Streets," keeping in view, more particularly, the needs of the villages, towns and smaller cities of Ontario, and it is hoped that the discussion by the members of the Association will contain much valuable experience gained throughout the province.

LOCATION.—A few of the older town-sites were laid out by the Government usually where, at the time of the survey of the district, a considerable population had gathered. In this way the Town of Niagara (formerly Newark), at one time the seat of the Government, came to possess its broad and well located streets. Later on the Canada Company, when sub-dividing its wild lands in the Province, also laid out sites for future towns, that on which the City of Stratford now stands being one planned by their surveyors. However, a great many of our present centres of population have never had the advantage of any well considered plan for the location of their streets. At some water privilege a grist mill was perhaps first built, soon to be followed by a blacksmith's shop, a general store, a hotel and a few dwelling houses, located on a more or less direct trespass road leading to the nearest Government road allowance. This road has probably for years been all that the hamlet required till the advent of a railway brought a demand for more building lots. Some enterprising owner of adjoining lands then decided to supply the demand and located new streets as he thought best, to enable him to sell his lots. Fortunately, during the last forty years, our laws have required that before deeds of these lots could be registered, a plan, prepared by some provincial land surveyor, should be filed in the Registry Office. Thus the land owner had the assistance of a more or less competent man, whose advice, however, he was free to follow or disregard. Usually the owner's object has been to get the greatest number of lots out of a given area with little consideration for the future, and so we often see new streets laid out without any regard to existing streets, or to future extensions and without any examination as to grade or drainage. It is high time that this lack of system be remedied and the writer would suggest that all plans be assented to by the Municipal Council before they may be filed, and not, only those showing streets of less than standard width, as the law now is.

WIDTH.- The Registry Act now requires that all plans with streets of less than the standard width of 66ft. must be assented to by resolution of the Municipal Council, but this assent is far too easily obtained by any influential land-owner. A By-law of the Council should be required to be carried by a two-thirds vote at its third reading, before any plan showing new streets is filed; and where the width is less than 50 ft. it should be confirmed by the County Council, as is now required when a Township or Village Council opens up a street less than 66ft. in width.

A greater width than 66ft. is seldom required even for a busy city street, and for residential streets 60ft. is an ample width and probably 50ft. is sufficient in most cases, as the tendency in the country towns is to allow the untravelled portion to become overgrown with grass and weeds. However, with streets as narrow as this, a "building line" should be laid down on every plan, say 25 feet from the street line, so that the rows of houses would really be 100 feet apart on a 50ft. street. Where comparatively narrow streets are laid out, the owner of the property can afford to dedicate an occasional square or gore as a public park, and as years roll by these will be the "lungs" of the future city.

CROSS-SECTION.—A business street should have sidewalks from eight to twelve feet in width slightly inclined towards the gutters. At the edge of the walk there should be a nearly vertical curb separating the walk from the carriage-way which occupies the balance of the street surface. A residential street unless calculated for street car tracks, does not require more than twenty-four feet between the curbs for the carriage way and from four to six feet will be wide enough for the walks, while the remainder of the street surface should be sodded. In some cases the walk is placed along the property line and separated from the carriage way by the sodded portion, while in others the walk is placed along the curb, and again in some few cases the walk divides the sodded portion into two parts. When the walk is placed along the curb, the sodded portion really becomes, to all intents and purposes, a part of the adjacent property and as such will undoubtedly have better care taken of it, and if a row of shade trees is planted between the walk and the houses, no unsightly fences will be required, and in addition the trees will not be damaged by being used as hitching posts for horses. However, the chief advantage is that in streets having a "tilted" cross-section it is much easier to fit in the street grade to suit the properties, and it is also easier to arrange streets intersections when the walks are along the curb lines.

GRADE.—In very few of our towns is any attempt made to fix the grades on streets; hence a person about to erect a building is unable to form any idea of the proper elevation at which to put the ground floor so that it may conform with the finished surface of the street, and it is a common occurrence to find buildings too low and others set ridiculously high in order to be out of harm's way. Every village, town and city should have the grades of its principal streets fixed by By-law, as this power is apparently given to every Municipal Council by the Municipal Act (Sec. 550), which provides that Councils "may pass by-laws for opening, making, preserving, improving, repairing, widening, altering, diverting or stopping up roads, streets, squares, alleys, lanes, bridges, or other public communications, and for entering upon, breaking up, taking or using any land in any way necessary or convenient for the said purposes; for setting apart and laying out such portions of any such roads, streets, squares, alleys, lanes, bridges or other communications, as the Council may deem necessary or expedient for the purpose of carriage ways, boulevards and sidewalks, or for the improvement or beautifying of the same!"

Sidewalks.—Wood has until recent years been the usual material used in the construction of sidewalks, although expensive stone flagging has been used to a limited extent in the larger cities. A mixture of coal-tar and gravel, erroneously called asphalt, has been tried in a number of places but usually with poor results. However, since the general introduction of Portland Cement, it has become possible, with the addition of sand and gravel only, to make artificial stone walks that are satisfactory in every respect, and the cheapest of all walks when the lifetime is considered. A harder and more durable walk is made with crushed granite, instead of sand, in the wearing surface, but it has the disadvantage of being very slippery under certain conditions.

Curb.—On gravelled or macadamized residential streets cedar planking forms an inexpensive curb, but where a more permanent roadway is to be constructed, stone curbing should be used. The writer, however, sees no reason why artificial stone curbing of superior form and capable of being laid with closer joints, could not be made at half the cost of cut stone.

Roadway.—In the majority of towns having good gravel close at hand this material continues to be used for the surfacing of all except the busiest streets, as a good gravel road-way thoroughly tile-drained can be made for 25 cents per square yard. For streets having more traffic a good macadam roadway with stone foundation can be laid for less than 40 cents per square yard provided suitable stone may be obtained within 50 miles by rail. Wood as a paving material for roadways is now practically out of the field. In our larger cities there is a demand for a roadway with a minimum of dust and dirt and a smooth surface. A concrete foundation is the first requisite and on top of this the surfacing material is placed. Asphalt at the present time is very popular, but the cost is great being from $2 to $2.75 per square yard according to specification. Vitrified brick is used very largely in the Western States; but as all brick is now imported, it has not been used to any great extent in Canada, and on a concrete foundation is no cheaper than asphalt. For the heaviest traffic of a city street granite setts on concrete foundation are used, costing about $4 per square yard.

Payment of Cost.—Before much progress can be made in any town towards good streets the Local Improvement System must be adopted, and to avoid any chance of trouble in the future a By-law should be submitted to the people providing that all street improvements shall be paid for by special assessment on the property benefited and according to the frontage thereof.

CONCLUSION.—If the farmers condemn the ignorance of the pathmaster and lament his inability to build good country roads, surely his methods should be excluded from the towns and cities where streets should be constructed according to the best engineering practice and with competent supervision.

DISCUSSION.

Mr. Gaviller—There is one point here that is a most important one, that is the establishment of the building line. Of course, as we all know, one of the great elements in streets is their width, and in country places where a small village cannot afford to have an efficient fire service, it is a great protection to have a good wide street. The law provides that in certain cases streets shall be laid out only of a proper width, but when the farmer, as we all know, stakes out village lots, his great idea is to get as many dollars for a square foot as he can for his land, and he does not consider the convenience of anybody. This is generally the case where a new village is commenced. It ought to be established by law, and this building line, I think, is one of the most important points in the paper.

Mr. Campbell—Can you oblige a person to build back to the line you establish ?

Mr. Gaviller—Certainly ; that is your idea isn't it, Mr. Bowman ?

Mr. Bowman—Well, in regard to that, of course if a building line is shown on a plan and especially mentioned in the deeds made according to that plan, no doubt it would be binding, but at present there is no provision by which a municipal council of a small town may prescribe the lines up to which houses may be built. But as to cities, there is a section in the Consolidated Municipal Act, 545a, which reads in this way:—" The municipal council of any city, having a population of 50,000 or more, may pass a general by-law prescribing the minimum width of streets, lanes, alleys or other public places within the municipality wherein dwelling-houses may be erected or occupied, and the minimum area of vacant land to be attached to and used with any dwelling-house hereafter to be erected, as the courtyard or curtilage thereof, and the mode of erection of buildings occupied or intended to be occupied as dwelling-houses.'

Now, it seems to me that there is no valid reason why that population limit should be placed there. It should be the council of *any* city, town or village should have that power. It is not likely they will exercise it to the detriment of the community, so that if the town council prescribed the distance from the centre of the road at which buildings might be placed on different streets there would be some uniformity.

Mr. Gaviller—I think that could be safely put in the hands of a township council and allow them to use their option in the matter, because we all know there is generally a pretty good vote in the villages and it is a vote that goes pretty solidly together, so that it is not likely the council would bring in an oppressive measure and kill their chances with the village vote. If that were extended to all villages it would be a very good idea.

Mr. Chipman—It is always a pleasure to read a paper of Mr. Bowman's. He writes so concisely that we can get at the points at once, and I think the Association is to be congratulated in having papers such as this presented. There are one or two points I would like to mention not touched upon in the paper, in respect to filing plans with township councils. I am of the opinion that these plans should be subjected to the supervision of some competent authority before being adopted. The plan itself does not show everything. I have known streets to be placed upon the most inaccessible rock, that could not be made accessible from other portions of the town without the expenditure of thousands of dollars. I have also found streets laid out along a running stream, the stream being zig-zagging across the street itself. In the town of Galt, where I am now putting in a sewer system, we find streets of considerable length, some 1,000 feet or more, without any cross streets, and the centre portion between the ends ten or fifteen feet below the ends, so that there is no possible outlet for drainage except by the purchase of lots. Now if proper profiles were filed with the plans or the elevations marked upon the plans themselves it would not be possible for these blunders to occur, which must be rectified at some time at the cost of the town at large. In Galt it is quite probable that new streets will be required. In the town of Brockville, in putting in a sewer system, we opened out a new street for several blocks, which was not required except for sewer purposes, but it was cheaper to do that than to purchase a right of way.

Another point I might mention is in regard to the width of the streets. In the east I know it was a common occurrence for the owner of a property to lay out streets half the proper width adjoining either one boundary or the other, he assuming that his neighbor when he laid out his property would give the other half. In this part of the Province I have known it to be the custom for an owner who is sub-dividing his property to lay out a street adjoining one limit of his property but leaving a small strip of one foot in width between the street and his neighbor, thus preventing his neighbor access to the street without paying for the privilege. Both these systems should be condemned. The men who are selling their properties should provide proper streets of the full width. You cannot get them too wide, but that remark I do not mean to apply to the travelled portion of the street. Mr. Bowman is quite right when he says that the travelled width of the street need not be more than twenty-four feet in width ; in fact, I think a less width than that would do on a residential street. It is a great mistake to lay out a roadway of any great width. I know of a town where they laid out a roadway half a mile or more in length, grading it very nicely, and it was really a beautiful looking street, but two years afterwards at least one half the width of that roadway was grown up with weeds, and the travelled roadway was a zig-zag across the street.

As to the question of cost, I will leave that to Mr. Ellis to speak about, but the question of sidewalks is one I have had some experience with. I am not satisfied that the concrete sidewalk is the proper one for any width more than five or six feet. By concrete I mean the concrete mentioned here, Portland cement, sand and gravel. Concrete of that kind being made in squares to resemble stone, I don't think its utility has been proven yet; we don't know how long it may last. Another difficulty is, that there is some trouble in putting in sewer connections and water pipe connections underneath it, especially for the business portions of the street. In the town of Belleville last year they put in, I think, nearly two miles of concrete sidewalks on the business portions of the streets. It looks like a good job; I hope it may be, but in that city the rock is only a short distance from the surface of the ground. They have their water connections in, but their sewer connections are not in, and you can imagine what expense and difficulty there will be in the future. It is a very foolish piece of business, which, I was surprised to find, some of the aldermen admitted In Guelph they are doing pretty much the same thing, but there is no rock there to speak of. Brantford, wisely I think, put in flagging instead of concrete on the business streets, using concrete only on the residential portions.

Respecting the use of tar asphalt, or coal tar and gravel, it has usually given very poor results, I believe. I found at London it was disintegrated in a short time, and when I was there a very few years ago they were then taking it out with picks and carting it away and replacing it with wooden sidewalks, planed, using wire nails. The object of the planing of the upper surface was that poor lumber was more easily detected, not from any superiority in its wearing qualities. The extra cost of planing was more than off-set by the better lumber secured and the ease of inspecting. As to this tar asphalt, the case I have mentioned is one where it was very poorly laid or very poor material used. In Barrie, where we put in a sewer system in 1892, it appears to wear unevenly, but it is not disintegrating to any extent.

Mr. Gaviller—It is a little too hard there ; they have petitioned against it ; they said it wore their boots out.

Mr. Chipman—Yes, the gravel projected through the tar, and it was really a cobble stone pavement, but there was no objection to it from disintegration. But in the town of Galt they have put in many miles of that sidewalk, and I must say it is about as pleasing a sidewalk as I ever walked upon. It is exceptionally well laid ; there is very little of it disintegrating, and they are putting in every year a larger amount. There is no other town in Canada where they have the method of constructing this tar sidewalk so perfected as they have in Galt. There is only one man in Ontario to-day, to my mind, that knows how to make tar sidewalk, and that is Mr. Curliss, of Galt. If I were interested in making tar sidewalks any place where I could get tar cheaply, I would certainly pay that man a very high salary for his services. In Stratford they have adopted a certain amount of it, to what extent I don't know. I would not like to say off-hand what they cost, but they are very reasonable, much less than concrete.

I don't know that I can add anything further; I am not prepared to go into the question of cost here, but I am of the opinion that vitrified brick or a brick that will answer for paving purposes can be laid for a much less sum than you would gather from the paper.

Mr. Ellis—There is one thing I wanted to speak about in regard to the width of the streets, that is, I see you say sixty-six feet is ample width for a street. Well, it is all right enough as long as you have not any street car tracks on it, but if you take sixteen feet six inches off the middle of the roadway for car tracks, and twelve feet on each side for sidewalks, that makes forty feet, it only leaves you about thirteen feet on each side available, and the result is that it hardly leaves you room to pass between the car and the next vehicle. I think streets on which there is to be a double line of street car tracks should be at least eighty feet wide. Another thing too, when a street is confined in that way with street car tracks on it, it throws the whole of the travel on exactly one portion of the roadway, and the result is your pavement goes to pieces just on those spots where the wheels go and where the horses keep hammering in the same place, whereas, if it were a little wider the travel would be more evenly distributed and the pavement would wear longer. In Toronto, on Bloor street, where they have got street car tracks and macadam roadway on the sides, it is impossible to keep it in good repair.

I see Mr. Bowman speaks about the cross-section of the street. That is very nice where you haven't any buildings, but where there are houses on both sides of a street, one side of which is a foot and a half or two feet higher than the other, you cannot slope it off to the buildings; if you do you are in for damages.

Mr. Chipman—In some places in the Province you haven't a difference in inches, but a difference of seven or eight feet from side to side.

Mr. Ellis—Well, then, you must go in for damages or something of the kind; there is no other way of getting at it, but I am speaking of where there is two or three feet. We have some places two feet and a half, but we have only paid $480 damages in the whole change of eighty miles.

In regard to the question of kerbing, there is a patent artificial stone kerb made, kerb and gutter I ought to say. It is used very largely in Duluth and several other cities. We have not adopted it here because we can lay stone cheaper. Stone costs us about forty cents a lineal foot delivered on the ground, six-inch stone kerbing, twenty-four inches deep. But the kerbing has given satisfaction everywhere it has been put in. In some cases, it is made hollow and electric connections and wires are run through that, so as to avoid disturbing the streets.

In regard to cost, I don't see how Mr. Bowman can put in a gravel roadway for twenty-five cents a square yard. We have to pay ninety cents a cubic yard for our gravel, and say you put on six inches of gravel, that would be fifteen cents for gravel alone without any rolling, or excavation, or grading, or anything.

In regard to macadam roadway, I would like to know what he pays for his stone. We have to pay from $16 to $20 a toise (216 cubic feet) for broken stone, broken to go through a two-inch ring. If you want a man to make you a broken stone roadway, the best gauge is to say, you must not put a piece of stone in that road that you can't put in your mouth. If he can put it in his mouth it is the right size, but nothing larger. Supposing you put, say, six inches of broken stone on the roadway, that would be $\frac{1}{6}$ of a cubic yard, and even at $2 that would be over thirty cents. But I would sooner have three inches of stone and an inch of gravel on top of that and thoroughly rolled.

In regard to the cost of vitrified brick, Mr. Chipman took some exception to that. Vitrified brick on concrete foundation costs us about $2.15 a square yard here, and we can lay asphalt pavement for $2.10. We have to pay $18 a thousand for vitrified brick. The cost of the brick is about $8 50 and the freight and duty is $10. I may say I was shown a sample of a new material of paving brick put in within the last few days that they propose to manufacture in Toronto. It has beaten anything I have seen yet in the way of vitrified brick that is imported from the States, and they say they can turn it out in Toronto for about $18 a thousand. They can not only turn it out in the shape of brick but in slabs six by four feet, and in the shape of columns, say, six feet long and eighteen inches through. I understand that they wish me to go down to New Jersey to examine and report on it for some of the people here, and I will know more about it then. They use the refuse clay from the brick kilns, the clay that is rejected and not fit for burning into brick. It will take a polish like granite. I saw some medallion work done here that looked more as if it had been engraved. They also use it for manufacturing mantelpieces and it polishes like marble. There is a piece of roadway of it in New York, down four years, and there is absolutely no wear on it at all, and it has some of the heaviest traffic in New York. It is called Pyro Granite. I put it in the "tumbler" with 300 pounds of shot and I gave it thirty revolutions to the minute, and kept it going for two hours, then I took it out and gave it another two hours after that, and I think there was one per cent. wear on it. So I came to the conclusion that it would stand fairly well.

In regard to the local improvement system, we are rather suffering from it here in Toronto, at least some say so. There is a difficulty about it in this way. Supposing, for instance, a person has a lot of property out in the suburbs and you go and lay a new pavement, who is going to carry on repairs? Why should the city pay that any more than anybody else? Why shouldn't they carry the local improvement system into repairs as well? They do in some towns but it complicates matters tremendously.

In regard to the plans and profiles of new streets before they are laid out, I think it is a very good idea, indeed, that every new street before being accepted by a city or municipality of any kind, the person laying it out should be compelled to put in plans and profiles subject to the approval of the municipal engineer. In some cities they will not accept a street at all until it is not only graded, but sewered and paved; the proprietor must do that before the municipality will accept it.

In regard to the one foot reserve, I have had a good deal of trouble with that here too, but now it simply means that the council will not accept any plan with a one foot reserve on it at all. We found ourselves tied up in several places.

Mr. Bowman—Under the city's special Act they require all plans to be submitted to them?

Mr. Ellis—Yes, to the city engineer for approval.

Mr. Bowman—But country towns have not that Act.

Mr. Ellis—I am not sure about that. I don't think they are obliged to accept a street; they may simply say, We won't accept the street, and we won't put any public work on it.

In regard to Mr. Chipman speaking about pavement of residential streets being less than twenty-four feet wide, I must say that I think he is mistaken. Take any ordinary buggy and it takes about twenty-four feet to get around. We have one or two where the pavements are eighteen and twenty feet here, and I have seen cases where there was a good deal of trouble before they could turn around, but in twenty-four feet you can do it comfortably.

Mr. DeGursé—I think twenty-eight feet should be the minimum width.

Mr. Chipman—Any ordinary driver can turn around in twenty-four feet, or even in twenty feet; and a poor driver, if he can't turn in twenty feet, can go to a lane or a street crossing.

Mr. Ellis—Yes, but the difficulty is they don't; they drive up on to the boulevard and get up on to the concrete walks.

Mr. Chipman was speaking about the difficulty with these walks of making connections. Of course they are a little difficult in that way, but we tunnel in every case.

Mr. Chipman—So do we, but that does not apply to where the rock is near the surface.

Mr. Ellis—In regard to the lifetime, we have had them here for nine years and they are in just as good condition as when they went down, they are not more slippery. I tried a new mixture on the Queen street walk, that is, through Queen's Park, last year or the year before. We dusted sand over it evenly, and instead of trowelling it to a fine polish we left it, and it is standing well and showing no signs of being slippery, whereas older walks have become very slippery indeed.

Mr. Gibson--What is the object of giving so much curvature to your asphalt roadways?

Mr. Ellis—Partly to get the water off.

Mr. Gibson—Well, but you get the horses down in every way, and we have a terrible time.

Mr. Ellis—Well, there is about six inches in forty-two feet. In regard to the price of sidewalks, I would like if Mr. Bowman could give me some information as to these tar sidewalks. Wooden sidewalks cost about five cents a square foot and you have to renew it every six years at the very least. If it doesn't rot out it wears out.

Mr. Gibson -I put down my sidewalks with cedar mud sills and they last ten or fifteen years.

Mr. Ellis--The average life of wooden sidewalks in Toronto, as given by the Street Commissioner, is five or six years. Of course we have some of them which last from ten to twelve years where they are not worn out by travel. I was trying to make a little calculation the other day as to what it cost at five cents a square foot, renewing every six years, and it cost about thirty cents at the end of thirty years. Now, take a concrete sidewalk, which costs about twenty cents, and it is certainly good for thirty years, so that would be a saving of ten cents a foot in that time, irrespective of interest.

Mr. Bowman—You notice this paper is not written as an authority or anything of that kind; it is more for the purpose of bringing out discussion than anything else, and it is not compiled from my own experience to any great extent; it is more from the reports of other engineers.

Mr. Chipman spoke in regard to the merits of concrete versus stone flagging for sidewalks, and I quite agree with him, that in a town having rock so near the surface as two feet, it would be very foolish for them to lay concrete sidewalks in advance of the construction of sewer connections, water works services and gas connections, but in places not having rock anywhere near the surface there is no great difficulty, as a concrete sidewalk properly made I think can be moved quite as readily as flagging. The blocks are probably not quite as strong, but if properly handled and put back again with a proper foundation they can be taken out as well as flagging. There is no comparison between the wearing of concrete and stone flagging of the kinds used in Ontario. If you go along King street, Toronto, you can soon see the quality of stone flagging. Yesterday, when it was wet, one had to be dodging in and out of pools of water, and that walk has been down I think not quite ten years; whereas, a little farther along the same block, at the Rossin House corner, you will find a walk put down at the same time, with granite surface, and you might say it is as good as the day it was put down

In regard to the remarks of Mr. Ellis about the width of streets, I may say that I was in my paper simply quoting the views advanced by Professor Haupt, in a paper that appeared in the January number of *The Engineering Magazine*, on "The Planning of a City," in which he advanced the opinion that sixty-six feet was ample width for business streets. However, I am glad to have the experience of Mr. Ellis brought out that this is not sufficient for a business street such as they have in the city of Toronto, and it would be valuable for the engineers of the Province to know that business streets should be wider than that, probably eighty feet.

In regard to the sloping of the streets, the conditions that obtain in a country town are not the same as in a city, and although it would be inadmissible to have the sides of the streets sloping towards the lots in a crowded city, still in a country town where there is usually only one house to every sixty-six foot lot, there is no reason usually why the water that falls on this portion of the street may not be allowed to drain across the lots.

In reference to the cost of gravel and macadam roadways, I may say that these figures were quoted direct from a paper read by City Engineer Campbell, of St. Thomas, in regard to his practice in that city. This paper was read at a meeting of the Good Roads Association a year ago.

I don't know that it is necessary to say anything about the local improvement system; it may have been abused here in Toronto, but throughout the country there is not so much danger of damage being done to the community by this as the "booms," one of which has lately exploded in this city.

Mr. Robertson—Don't you think that the streets of the future should provide for bicycle tracks as well?

Mr. Ellis—In regard to the wooden pavements, Mr. Bowman says they have practically gone out. Well, there is a good deal of truth in that, but at the same time they are the cheapest pavement and easiest laid you can possibly get. A young town can lay cedar blocks for about fifty-nine to sixty cents a square yard, and even if you renew it every four years it is a cheap pavement, and it keeps the roadway in fairly good travelling order until the community can afford to put down a first-class pavement.

A Member—It is all very well for places where real estate is very valuable, and they can afford it, to put down costly pavements; but taking growing towns, I think there is no pavement that will meet the requirements of the people so cheaply as wooden pavement.

Mr. Gibson—And have first-class drainage.

Mr. Gaviller—Yes, and a good fresh breeze blowing over it in the morning. The objections to the pavement are on sanitary grounds, I think, as well as the cost and quickness of its wearing out; and its absorbing qualities are rather too great.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

MINING AND SMELTING OF THE COPPER NICKEL ORES OF THE SUDBURY DISTRICT, ONT.

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It was in the year 1883 that copper ore was first discovered in this district by rock cuttings made during the construction of the Canadian Pacific Railway; but it was not until late in the year 1886 that the discovery was made that nickel was associated with the copper, the latter occurring in copper pyrites (chalcopyrite) and the nickel in magnetic iron pyrites (pyrrotite), these two minerals being more or less intermixed and the one or the other prevailing.

These ore bodies occur usually in irregular large masses or isolated patches through the gangue rock (diorite). No well defined veins have been so far discovered. The deposits are extremely variable in their form and occurrence, sometimes cropping out on the slopes of hills, or on the top, while at other places indications are that the heaviest bodies of ore may be found in flats adjacent to elevated ground or ridges of rock.

When prospecting for and opening up a body of ore the work must be done with very primitive appliances, but so soon as the work done reveals a body of ore sufficient to warrant it, machinery should be employed, and in course of time that of the most approved description, for handling and treating the product, with a minimum outlay for manual labor, should be provided in order to be able to compete with those mines fully equipped with such machinery and appliances.

This equipment should consist of a suitable shaft-house and rock-house, which may be combined in one building, if surrounding circumstances admit of it, and provided with a suitable hoisting plant, rock crusher, revolving screens, assorting tables and a number of hopper bins for receiving the various classes of broken ore, etc., and also a ready means of reloading on to cars for transportation to the roasting yard.

The ore having been broken in the mine, with the use of dualin, in the usual way, and reduced to a size sufficiently small to be handled and loaded into tram cars by manual labor, it is hoisted to the surface in skips, or tram cars, or other equally suitable manner, and to an elevation in the rock house of a sufficient height to enable all the following methods of treatment to be done to the ore by gravity. The ore having been discharged from the skip or tram car and delivered near to the crusher, any rock or ore of too low a grade should be sorted out and sent to the waste dump, the remainder is then fed into the machine, which should be set to reduce it to a size that will pass through a 2½-inch ring. From the crusher it passes into a revolving screen about 10 feet in length set in a slight incline (say 1 in 12), and having holes of two different dimensions; those occupying the first or upper 5 feet long of the screen should be ⅜-inch in diameter, and throughout the remainder 1½ inches in diameter. The product from the crushers, while passing through this screen, will be separated into three grades of fineness; that of the first is designated "fines," the second as "middlings" or "ragging," and that which passes along and discharges at the end of the screen is called "coarse" ore. The fines and ragging discharge into separate bins and are used as will be described hereafter; the coarse ore is, however, discharged on to a shaking table, set on a small incline, or any other device of a similar and suitable description. As the product passes along the length of this table all rock and low grade ore is picked off by boys or men (ranged along the sides of the table) and thrown into bins provided for the purpose. The good ore is discharged over the end into a bin or other receptacle.

From these various bins the product is drawn off by gravity and discharged into tram or railway cars, as circumstances necessitate, and is transported to the roasting yard.

In this condition the ore will assay about 5 or 6 per cent. nickel and a like percentage of copper. This, however, is subject to much variation, the copper and nickel contents vary very materially, usually from 2 to 10 per cent. for each of these metals and in rare instances up to 18 or 20 per cent. The iron and silica also vary, some ores having iron in excess and others silica.

The next process is for the purpose of getting rid of the excess of sulphur and consists of roasting or calcining the ore. The roasting yard should be at some considerable distance from the mine, from one half to a mile distant and usually in a south-easterly direction, in order that the sulphur fumes, arising during combustion, may cause as little annoyance as possible where the mining operations are carried on and the prevailing winds will carry these fumes away from the mining works.

If the nature of the ground admits of it, there should be two railway or tram tracks prepared with the roast heaps between, one elevated track to be used for placing the green or raw ore upon the heaps and the other a low track for removing the roasted ore from the piles or heaps. These heaps may be of any desired dimensions, but perhaps the most convenient and suitable would be about from 40 to 50 feet wide and from 100 to 120 feet long, with a passage way of, say, 4 or 6 feet between them. The space devoted to the roast yard should be of sufficient length to enable as many of these heaps to be built as will be necessary under the circumstances, which will depend entirely upon the output of the plant.

The floor of this yard should be prepared and made with a slight fall in cross-section and should be made impervious to surface water with a layer of clay or other suitable composition, and this should be covered with a layer of from 4 to 6 inches of fines (fine ore) before commencing to build the ore piles or heaps. The bottom for these piles is first laid with about 15 inches of wood ; dry pine is very serviceable, or say two sticks of cordwood high regularly laid down in tiers, and provided with air spaces or canals about a foot wide at the ends of each tier, which is filled with fine kindling wood and will thus form flues for the fire to follow. Upon this wood is placed the coarse ore which is piled up to a height of about 6 feet, the sides and ends standing at a slope of about 45 degrees. This body of ore is then covered, top, sides and ends, with 6 or 8 inches of ragging or middlings and finally with a light layer of fines. To fire this heap a small quantity of kindling and cordwood of dry pine is placed along the ground all round and against the outer margin and fired, the fire making its way gradually into the interior. At this stage great precautions are necessary and a constant watch must be kept to prevent the fire from burning too rapidly. Cracks and openings will form in the outer crust, due to the wood being consumed and the ore settling, thereby creating too great a draft and too much heat and thus causing the ore to melt and run together in large masses and give endless trouble and expense in breaking it up again. This can be largely avoided by throwing on fresh fine ore and thus check over-burning. After the fire is well started, say from 4 to 6 days, combustion will proceed without much further attention for from 60 to 90 days, the fuel being furnished by the sulphur contained in the ore. After the fire has expended itself and the pile cooled off, the ore is ready for the next process, that of smelting.

During the process of roasting a large percentage of the sulphur is thrown off and oxygen is taken up. Sufficient sulphur should, however, remain in the ore to carry on the process of smelting successfully.

The next process is smelting. The ore is taken from the roast yard and transported to the smelting furnace where it is deposited in suitable bins adjacent and convenient to the charging door of the furnace. Smelting is for the purpose of eliminating all rocky constituents and a large per cent. of the iron and thus reduce the weight of the resultant to from about one-seventh to one-twelfth of that of the ore charge, the product being known as matte, containing copper, nickel, sulphur and iron. A charge may consist of any quantity of ore from 2,000 to 6,000 lbs. at a time, with the requisite quantity of coke about one-seventh in weight. The best furnace for modern work is that known as the Herreshoff Water Jacketed Blast furnace, consisting of a shell, oval in shape, in plan 4ft. x 7ft. at the tuyeres and 8 feet deep from the charging door, set up upon cast-iron legs about 2 feet from the floor, built of sheet steel, the inside lining being five-sixteenth inches thick and the outer one-fourth inch and having a two inch water space between ; the bottom consisting of a cast-iron plate covered with one tier of fire brick. The tuyeres are 13 in number, 5 on each side and 3 at the back. In front of the furnace is placed a circular fore hearth or well made of cast iron, with a water space similar to the furnace around the circumference, which is lined throughout with fire brick ; it has also a cast iron lid or cover. This well is about 3 feet in diameter and 2 feet deep and is placed on four wheels for easy transportation. It has an opening in the back near the bottom, opposite to a similar opening in the furnace, through which the molten material flows and fills up the well to the top. A lip is formed in front at the upper edge, over which the slag, which separates from the heavier matte and floats to the surface, flows in a steady stream and discharges into a cast-iron pot provided for the purpose. This pot is removed at intervals and another substituted. In the meantime the matte continues settling and accumulating at the bottom of the well until a sufficient quantity is stored up when it is withdrawn through an opening called the tapping hole, placed at the side and at the height of about the centre line of the well. When a sufficient quantity has been taken the hole is closed with a clay plug. This process is repeated as often as is necessary, great care being taken to prevent any of the matte passing off with the slag and also the slag following the matte when tapping. The difference in appearance between these two products can be readily detected by a practised eye and easily recognized by the workman.

A furnace of the dimensions mentioned is capable of smelting from 100 to 125 tons of ore in 24 hours. Under very favorable circumstances as much as 150 tons have been smelted. The resultant matte will assay from 15 to 25% nickel and 20 to 25% copper, the slag about $\frac{3}{10}$ to $\frac{5}{10}$% of 1% of each (nickel and copper), this last showing a loss of less than 1% of the two metals, which is considered very good work. In the process of separation of the matte from the slag in the well, the sulphur performs a very important part. It first takes up or absorbs the nickel and then the copper, after which it takes up iron. If there should not be sufficient quantity of sulphur to take up all the copper and nickel and some iron, a loss would be entailed, as copper and nickel would go off with the slag. Had the roasting process been carried too far, thus leaving an insufficient quantity of sulphur, the shortage could easily be made up by introducing a certain quantity of green or raw ore in the charge.

The furnace charge is made up of ore and about $\frac{1}{7}$ its weight of the best coke, there being no necessity for any flux of any description, providing that the ores are assorted so as to give the requisite quantities of silica and iron.

The matte can be raised to a higher grade by a process called bessemerizing or blowing in a converter. This can be done by passing the molten matte at once to the converter, or it can be resmelted in a cupola and then transferred to the converter. During the process of blowing, the iron is oxidized and is removed in the form of slag, as is also a portion of the sulphur, resulting in a product carrying from 8 or 10 to 15% sulphur, the balance being copper and nickel.

The further process of refining the copper and nickel as an alloy, or separating the two metals and producing them in the pure metallic form, or as an oxide, cannot be done in Canada, there being no works for that purpose. But the matte is shipped to the United States or Europe to undergo further treatment.

In order to ascertain the value of the product of the mines and furnaces and the loss, if any, during the process of roasting and smelting, repeated assays are made.

Samples should be taken from each and every ton of ore shipped from the mine and assays made thereof, say once a month, also of samples taken from the charges at least every six hours and assayed every week, also of samples taken from each pot of matte when in its liquid condition and the same of the slag taken as often. These should be assayed for every day's run.

It is essentially necessary that the furnace charges should be very carefully weighed for each and every charge, and in order to have correct returns of all the products, the ore should be carefully weighed on track scales in transit from the mines to he roast yard, as also each and every pot or other unit of matte should be weighed and preferably while in its liquid state.

DISCUSSION.

The President—It just occurred to me while you were talking about sulphur going to waste, why they could not utilize it for the manufacture of sulphide pulp.

Mr. Evans—That question has often been taken up, but the ore is of a magnetic quality and is a mono-sulphide, and it requires bi-sulphide to make it valuable.

APPENDIX.

BIOGRAPHICAL SKETCH OF LIEUTENANT-COLONEL JOSEPH BOUCHETTE, SURVEYOR-GENERAL FOR THE ESTABLISHMENT OF THE INTERNATIONAL BOUNDARY, UNDER THE TERMS OF THE TREATY OF GHENT, IN 1817-18; ALSO SURVEYOR-GENERAL FOR LOWER CANADA.*

ONE of the ablest topographers of the age, he was born in Canada in 1774, and was the son of Commodore Bouchette, who distinguished himself by an exploit which history has recorded and which is well known to have prevented the threatened surrender of the Canadas to the arms of America—"the taking of General Carlton (Lord Dorchester), which appeared almost certain, would have rendered their fate inevitable."

Commodore Bouchette, however, landed the commander-in-chief in safety at Quebec, after escaping the most imminent danger that menaced them in their descent of the St. Lawrence from Montreal to Quebec, the banks of the river being occupied by the enemy who were bivouacked on the shores of its narrow passes.

As early as the year 1790, Lieutenant-Colonel Bouchette was employed as a draftsman in the office of his late uncle, the Hon. Major Holland, then Surveyor-General of British North America, and subsequently of Lower Canada, after the division of the Province of Quebec.

In 1791 he was tempted to follow the profession of his father, and in consequence entered the provincial navy, and sailed on the great lakes in Upper Canada till 1796. In the year 1794, at a very early period of his life, he succeeded, through the most vigorous exertions in raising and saving His Majesty's war vessel *Onondaga* (the Commodore's ship), carrying 14 guns, which had been cast away in York (now Toronto) harbour, and totally abandoned as lost; and taking the command, he sailed with her to Niagara, where he was received amidst the cheers of the garrison and others assembled on the shores to greet the arrival of the rescued vessel.

This service elicited the unqualified approbation of Lord Dorchester, and "young Bouchette" was promoted, on the 12th May, 1794, to the rank of Second-Lieutenant in the provincial navy.

He continued in the command of an armed vessel until 1796 during which period he made surveys of the most important harbours on

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*From "Sketches of Celebrated Canadians," by Henry J. Morgan, and "Portraits of British Americans by W. Notman, with Biographical Sketches edited by Fennings Taylor.

Lake Ontario, including the harbour of York, previous to that place being established as a military post and town in 1793.

The provincial navy was partially reduced in 1796 and it was Lieutenant's Bouchette's lot as junior officer (then commanding an armed vessel) to be included in the reduction. Owing, however, to the illness of officers who remained in command, he continued on duty for several months afterwards, successively commanding the vessels of those officers who were victims to the fever and ague, so generally prevalent. His activity meanwhile had not been altogether unnoticed, for he immediately obtained an unsolicited lieutenancy in the Battalion of of Royal Canadian Volunteers; and having raised his quota of men continued in that provincial corps until its reduction in 1802.

Being known to possess some nautical knowledge, he was selected in 1797 to command an armed row-galley, with a detachment of 30 men of his regiment, and four artillery-men, to cruise between Quebec and Montreal, in order to detect certain treasonable practices, which led to the execution of Colonel McLean, an American, at the former place. This service afforded Colonel Bouchette an opportunity of conveying much valuable information to the Government, relative to the soundings, etc., of the harbour of Montreal and several other sections of the St. Lawrence.

In 1800 he was the officer chosen by the order of His Royal Highness the late Duke of Kent, then commander of His Majesty's forces in North America, to repair to Halifax with a detachment of his regiment to acquire a more uniform system of military tactics, and subsequently conveying the same to his own regiment, which he effected to the entire satisfaction of the commander in-chief in Canada, by whom he was appointed Adjutant of the regiment.

By this time Major Holland, the companion-in-arms of the immortal Wolfe, had become, through age and infirmity, in some measure inadequate to the duties of his laborious office of Surveyor General, and Lieutenant Bouchette was in consequence attached to his department. After Major Holland's death in 1803, he was appointed deputy Surveyor-General, and in the following year received His Majesty's commission of Surveyor-General of Lower Canada and thus became the successor of his venerable uncle.

During the American war of 1812, he was actively employed in the campaign in conveying important despatches from headquarters to Major-General Sir Roger Sheaffe, commanding in Upper Canada, with confidential instructions to report on the general defensive state of the frontier, whether possessing any interesting posts and at the same time to reconnoitre and ascertain the position and strength of the enemy as he proceeded. For this service he received high commendation and his views of the defenceless state of York, now Toronto, and of the manner in which it would be taken by the enemy proved but too prophetic.

In November 1813, at a very critical juncture, he was ordered to repair to Lachine whither it had been found expedient to assemble a considerable force, and, on the 9th, that place became the head quarters. He accompanied the commander of the forces to Coteau-du-Lac, where he received important reconnoitering instructions. The American generals, Hampton and Wilkinson, were at this period concerting a junction of their respective armies; the one marching into the Province by the Chateauquay country, whilst the other descended the St. Lawrence. Their project was frustrated and ended in a repulse and precipitate retreat within the limits of their own territory.

Colonel Bouchette had, however, previously followed up closely his instructions, and did not return to Lachine until he had ascertained the strength and position of the enemy at the cross-roads, some miles above McMartin's mills on the Riviere aux Raisins, and, under cover of the night, proceeding in a canoe with two Indians to the mouth of that river, crossed over to the south side of Lake St. Francis, near the Salmon river, to watch the movements of the enemy, then in full retreat; being uncertain, however, whether they meant to proceed further down the St. Lawrence (although about entering Salmon River), he immediately went down the Beauharnois channel, ascertained the condition and situation of the gun-boats, and, having put the forces on that line of military communication on their guard, he repaired to headquarters to submit his report.

In the month of August 1814, the project he had long conceived of publishing a topographical and geographical exhibit and description of Canada, being matured, notwithstanding the various other objects, of a military character, he had been called upon to attend to, he sailed from Canada to England, on board the man of war *Ajax*, for the purpose of personally superintending the publication of his work.

The colonial patronage this work received from the governor-in-chief and provincial legislature paved the way to the distinguished countenance and auspices under which it was afterwards produced to the world.

Colonel Bouchette, whilst in England, was nominated Surveyor-General, under the several articles of the Treaty of Ghent, for establishing the boundary between His Majesty's possessions in America and the United States. After his appointment, he prepared, at the instance of the Commissioners and the agent under that treaty, a project of operations for the year 1817, which he submitted to the Board at Boston.

In the spring of that year he commenced his field operations; and, after erecting a monument, in conjunction with the American surveyor, at the source of the River St. Croix, from whence the land boundary departs, he proceeded in the establishment of the due north line from that point, dividing New Brunswick from the State of Maine, to the highlands, continuing, however, the exploration line to the extent of one hundred miles in the wilderness, making numerous exploratory surveys of the various rivers intersected in his progress, and sketching the face of the country, frequently from the summit of the loftiest trees, to the imminent peril of his life.

By these arduous means he ascertained the position of the several ridges of highlands, stretching westward from the exploring line, and was enabled to judge, from their continuity and elevation, which ridge was most likely to become the boundary between both territories, in virtue of the fifth article of the Treaty of Ghent.

The result of his labors during the summer of 1817 was conveyed to the Board of Commissioners in extensive and explanatory plans, sections and reports, for which he received the commendation of the Board, and upon which the strongest arguments of His Majesty's agent were chiefly grounded, in claiming the whole extent of country north of Mars Hill ridge of highlands, which is that pointed out by Colonel Bouchette as the legitimate boundary between that part of the British possessions and the territory of the United States. And, although the Ashburton Treaty of 1842 afterwards yielded to the pretensions of the United States to a boundary much further north, and coming within a few miles of the St. Lawrence, it is now generally admitted that the line of boundary pointed out by Colonel Bouchette was that upon which the British negotiator should have insisted.

The ensuing season he was proceeding to the establishment of the geographical boundary on the 45th parallel of north latitude when he was taken dangerously ill at Montreal, on his return from Burlington, where he had met the Board, and received its encomiums for his field services of 1817 ; and, from the continuance of his illness during part of the summer, the service was performed by Mr. Tierks, as His Britannic Majesty's astronomer.

In 1827, with a view of ascertaining the statistics of Lower Canada, he visited all parts of the Province, and, devoting himself to long and laborious researches, he deduced explanatory reports and tabular statistical statements, that met with the marked approbation of His Majesty's representative in the colony.

Availing himself of these several tours as a means of perfecting his topographical work on Lower Canada, he solicited from the seigneurs copies of the plans of their respective *fiefs* and *seigneurs*, and was enabled to compile maps of the Province still more voluminous and correct than the former ; and, desirous of rendering the information thus acquired as generally useful as possible, not only to the Government, but to the public in the mother country and the colony, he repaired to England in 1830, under the formal sanction and support of the Provincial Legislature and the approbation of the Executive Government, to superintend the publication of a new work on the topography, geography and statistics of Lower Canada, which grew out of the materials studiously collected during the previous fifteen years, with a view to the accomplishment of that object.

The works published by Colonel Bouchette are as follows :

1815.--Topographical maps of Lower Canada in two sections. First, District of Quebec, Three Rivers and Gaspé. Second, the District of Montreal. Geographical map of British America and of the United States. These maps, which were published on a very large scale, were accompanied by a topographical description of Lower Canada. They were, moreover, published simultaneously in English and French.

1831.—British Dominions in North America, 2 vols. 4to.; elegantly printed and illustrated with vignettes, views and plans. Topographical Dictionary of Lower Canada, 1 vol. 4to. Topographical map of the District of Quebec and Three Rivers. Topographical map of the District of Montreal. Geographical map of British America and of the Northern, Western, and Central States of America This map, though published by the subject of this sketch, was, it is said, compiled by his eldest son.

Colonel Bouchette died at Montreal on the 9th April, 1841, and was buried in the Church of Notre Dame in that city. We cannot, in concluding this memoir, do better than to quote the following passage, taken from one of the many obituary notices of his death, which appeared in the public journals of the time:

" For sentiments of loyalty to his sovereign, and he honestly and faithfully served not less than four of them; for his veneration and attachment to constitutional government, and for the perpetuation of the connection of his native Canada with Great Britain, the late Surveyor-General was also conspicuously distinguished. With such qualities both of head and heart—and we regret that we cannot, on the present occasion, do them greater justice—the memory of Colonel Bouchette will be long cherished by his surviving friends, and his public labours reflect honour and credit upon his native country."

PAPERS USED AT THE APRIL, 1895, SESSION OF THE BOARD OF EXAMINERS.

BOARD OF EXAMINERS' RECORDS

BETWEEN JULY, 1892, AND FEBRUARY, 1895.

PRELIMINARY CANDIDATES.

NAME.	ADDRESS.	DATE OF CERTIFICATE.
Abrey, George Spencer	Toronto Junction	12th November, 1892.
Code, Abram Silas	Glencoe	" " "
Hopkins, Marshall Willard	Stony Creek	" " "
Bolton, Ellsworth Doan	Listowel	8th April, 1893.
Richardson, Jocelyn Johnston	St. Catharines	" " "
Heaman, John Andrew	London	9th November, 1893.
Bow, James Alexander	Orillia	4th April, 1894.
Ford, William Butterton	London	" " "
Gibson, Wilbert Silas	Willowdale	" " "
Maclean, William Arthur	St. Thomas	" " "
McNaughton, Finlay Donald	Cornwall	" " "
Newman, John James	Windsor	" " "
Ward, Archeson Thomas	Toronto	" " "

(No candidates for Preliminary Examination at November, 1894, session.)

FINAL CANDIDATES.

NAME.	ADDRESS.	DATE WHEN SWORN IN.
McMullen, William Ernest	Toronto	11th November, 1892.
Deacon, Thomas Russ	North Bay	12th " "
Moore, Thomas Alexander	London South	" " "
Newman, William	Leamington	" " "
Silvester, George Ernest	Ringwood	" " "
Beatty, Herbert John	Pembroke	8th " 1893.
Harvey, Thomas Alexander	London	13th " "
Hopkins, Marshall Willard	Hamilton	" " "
McLennan, Murdoch John	Williamstown	" " "
Fairchild, Charles Court	Brantford	9th April, 1894.
Allan, John Richard	Renfrew	6th November, 1894.

PRELIMINARY.

(No candidates).

FINAL.

Subject No. 1—Geometry.

Max. Marks 100, Min. Marks 50.

1. All the exterior angles of any rectilineal figure are together equal to four right angles. Prop. 32, bk. i.

2. In any right-angled triangle the square which is described upon the side subtending the right angle is equal to the sum of the squares described upon the sides which contain the right angle. Prop. 47, bk. i.

3. Trisect a right angle.

4. If a straight line be divided into two equal and also into two unequal parts, the squares of the two unequal parts are together double of the square of half the line and of the square of the line between the points of section. Prop. 9, bk. ii.

5. If from the vertex A of a right-angled triangle, BAC, AD be dropped perpendicular on the base, show that the rectangles of BC and BD, BC and CD, BD and CD are respectively equal to the squares upon AB, AC, AD.

6. If from any point without a circle two straight lines be drawn, one of which cuts the circle, and the other touches it, the rectangle contained by the whole line which cuts the circle, and the part of it without the circle shall be equal to the square of the line which touches it. Prop. 36, bk. iii.

7. The angle at the centre of a circle is double of the angle at the circumference upon the same base, that is, upon the same part of the circumference. Prop. 20, bk. iii.

8. To inscribe an equilateral and equiangular pentagon in a given circle. Prop. 11, bk. iv.

9. In a right-angled triangle if a perpendicular be drawn from the right angle to the base, the triangles on each side of it are similar to the whole triangle, and to one another. Prop. 8, bk. vi.

10. To cut a given straight line in extreme and mean ratio. Prop. 30, bk. vi.

11. To find the centre of a given circle. Prop. 1, bk. iii.

SUBJECT NO. 2—ALGEBRA.

Max. Marks 100, Min. Marks 40.

1. Find the arlthmetical, geometrical, and harmonical means between 2 and $4\frac{1}{2}$.

2. Solve $\frac{7x+1}{x-1} = \frac{35}{9}$; $\frac{x+4}{x+2} = 3\frac{1}{9}$

3. (*a*). To what power is x raised by being multiplied n times by x? (*b*). Express x^{-a} in another form.

4. Define "pure" and "affected" quadratics and give an example of each.

5. Solve $\frac{10x^2+17}{18} - \frac{12x^2+2}{11x^2-8} = \frac{5x^2-4}{9}$

6. The stones which pave a square court would just cover a rectangular area whose length is six yards longer and breadth four yards shorter than the side of the square. Find the area of the court.

7. There are two bars of metal, the first containing 14 oz. of silver and 6 oz. of tin, the second containing 8 oz. of silver and 12 oz. of tin. How much must be taken from each to form a bar of 20 oz., containing equal weights of silver and tin.

8. A train, an honr after starting, meets with an accident which detains it an hour, after which it proceeds at three-fifths of its former rate and arrives 3 hours behind time, but, had an accident happened 50 miles further on, it would have arrived $1\frac{1}{3}$ hours sooner. Find the length of the line

GROUP NO. 3—TRIGONOMETRY, PLANE AND SPHERICAL

Max. Marks 100, Min. Marks 50.

1. What is the value of the unit of circular measurement expressed in minutes? Show how this value is arrived at.

2. Write down the trigonometrical ratios of an angle and show which are reciprocals.

3. Given three sides of any plane triangle, show formulæ for angle A in terms of sin $\frac{1}{2}$A, cos $\frac{1}{2}$A. Prove the truth of the formulæ.

4. From an eminence of 268 feet in perpendicular height, the angle of depression of the top of a steeple which stood on the same horizontal plane, was found to be 40° 3′, and of the bottom, 56° 18′. What was the height of the steeple? Illustrate your solution by a diagram.

5. Find area of a triangle, two of whose sides are 80 and 90 feet and the contained angle = 28° 57′ 18″.

6. State and prove Napier's Rules of Circular Parts.

7. In any spherical triangle the sines of the angle are proportionate to the sine of the opposite side. State as a formulæ and prove the truth of the expression.

8. State and prove Napier's Analogies.

9. Given $a = 68° 20' 25''$, $b = 52° 18' 15''$, $C = 117° 12' 20''$. Find c, A, B.

GROUP NO. 4—MENSURATION OF SUPERFICIES AND LAYING OUT AND DIVIDING LAND.

Max. Marks 150, Min. Marks 75.

1. Explain the method and give the formulæ for finding the areas of a triangle, a circle, and a regular polygon.

Find the areas of the following:

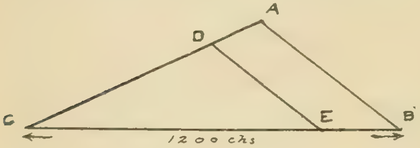
Triangle, 2 sides being 24 yds, 17.6 yds., included angle 30°.

Triangle, equilateral, perimiter = 125 ft. Give area in sq. yds.

Find the length of the minute hand of a clock, the point of which moves over an arc of 5 in. in $3\frac{1}{4}$ minutes.

2. Define the terms—Latitude, Departure, Course, Distance.

How are areas calculated by Latitude and Departure.



3. Describe and explain the uses of a traverse table.

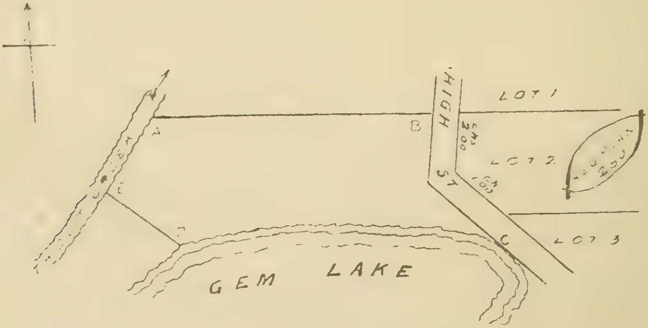
4. Area of A B C = 12.96^{ac} Cut off 3.24^{ac} from E by a line // with A B. Find CE.

SUBJECT NO. 5—DESCRIPTIONS.

Max. Marks 100, Min. Marks 75.

1. If, in a description, a distance is given "more or less to a post," and the position of the post cannot be found, what would govern for such distance?

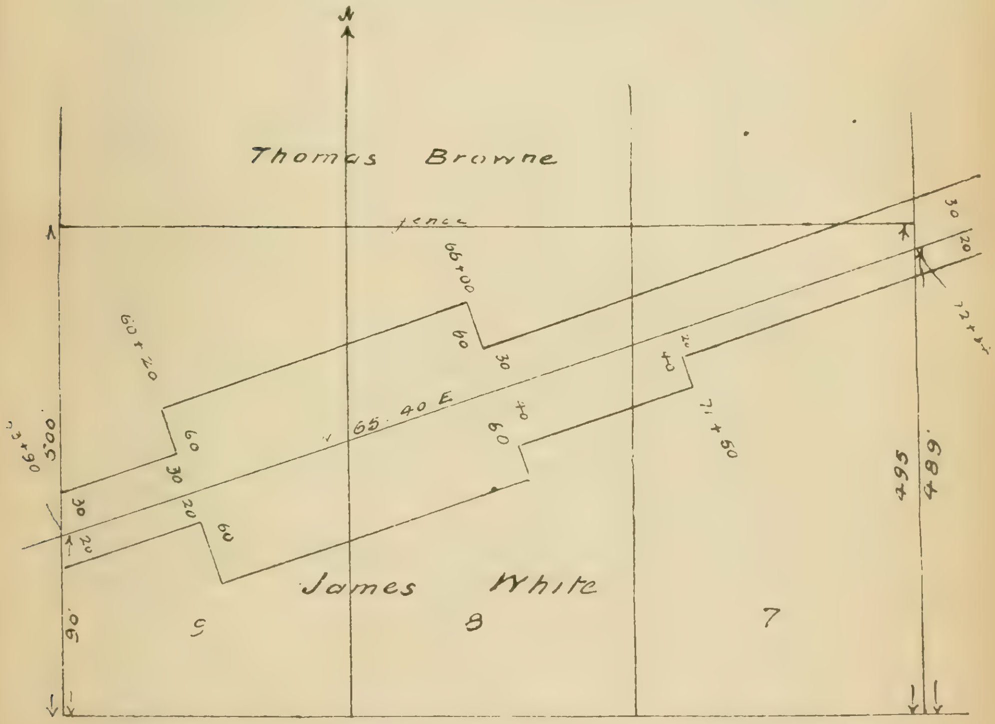
2. Define a boundary to the shore of a lake, and to the shore of a mill-pond.



3. Write a description of property A B C D in the above diagram, giving imaginary bearings and distances.

4. Describe, by metes and bounds, the north-east two acres of a 200 acre lot, in a double-front concession in a township in which the concession lines run due north and south and the side lines due east and west.

5. Define the terms (*a*) "Party wall," (*b*) "Centre line," with reference to right of way of a railway.



6. Calculate area in acres and describe lands required from James White.

GROUP No. 6—USE AND ADJUSTMENT OF INSTRUMENTS FOR SURVEYING AND LEVELLING.

Max. Marks 100, Min. Marks 70.

(Vivâ voce.)

SUBJECT NO. 7—THE LAYING OUT OF CURVES.

Max. Marks 50, Min. Marks 20.

1. Show, by lettered diagram, and explain the meaning of the following terms: angle of intersection, degree of curve, length of curve, radius of curve, deflection angle, simple, reversed, and compound curves.

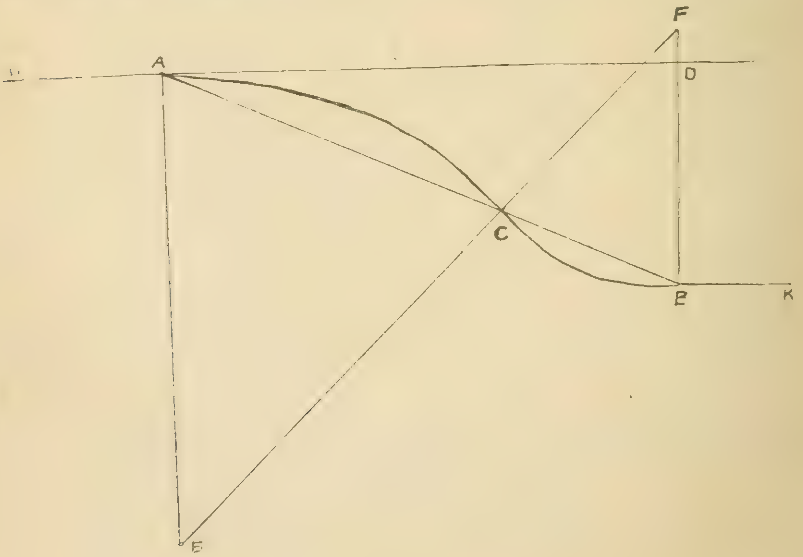
2. Show, by lettered diagram, and prove, (*a*) That the angle of intersection is equal to the central angle subtended by the chord joining the tangent points; (*b*) That the deflection angle is equal to half of the degree of curve; (*c*) That the reversing point of a reverse curve between parallel tangents is in the line joining the tangent points.

3. (*a*) Show, by lettered diagram, and explain how to lay out on the ground, simple, compound and reverse curves. (*b*). If a 2° curve has been located and it is desirable to change the curve so that the E C may be on a tangent parallel to, and a few feet from, the former, but preserving the B C; shew by lettered diagram, and explain how to find the degree of the new curve—the angle of intersection being known.

4. Given angle of intersection, I = 16°..52′ and deflection angle D = 1°..20′; find the length of curve.

5. Given angle of intersection, I = 28°, and deflection angle, D = 1°: find the tangent.

6. Show, by lettered diagram, how to lay out a curve by tangent and chord deflections.



7. Given the perpendicular distance between two parallel tangents $BD = b = 8$ feet, the distance between the two tangent points $AB = a = 100$ feet and the first radius, $EC = R = 900$ feet; of a reversed curve uniting the tangents H A and B K; find the chord $AC = a'$ and radius $CF = R'$.

Subject No. 8—Practical Astronomy.

Max. Marks 150, Min. Marks 75.

1. Show, by lettered diagram, and explain the meaning of the following terms: azimuth, hour angle, prime vertical, celestial longitude, true horizon, sensible horizon, dip, parallax, ecliptic, right ascension, declination, equation of time.

2. Show, by diagram, the relative positions of Ursa Major and Ursa Minor with Polaris on its upper transit; also show, by lettered diagram, and explain how to obtain the azimuth of Polaris on its eastern elongation and draw a meridian line.

3. In latitude $24° .. 30' .. 00''$ N., in the forenoon, the true altitude of the sun's center was $33° .. 20' .. 00''$ when its declination was $6° .. 47' .. 50''$ S. What was the apparent time of observation?

4. When in latitude $48° .. 51'$ N, the sun's declination is $18° .. 30'$ N., and its altitude $52° .. 35'$; what is its azimuth from the north?

5. At a given place in south latitude, when the sun's declination is $15° .. 8' .. 10''$ S., and its true altitude $39° .. 5' .. 28''$, at 2h .. 56m .. 42.7 sec. p.m.; find the latitude of the place.

6. Show, by lettered diagram, and explain the three systems for finding the position of a body on the celestial sphere by spherical coordinates.

7. Show, by lettered diagram, and explain the method of finding the latitude of a place when given two altitudes of the sun and the interval of time between the observations.

Subject No. 9—Survey Act.

Max. Marks 150. Min. Marks 90.

1. Give definition of a "proof-line;" and when would you use it?

2. State what steps should be taken to have monuments planted on governing lines of townships.

3. In cases where concession lines and side road lines or parts of same were not run in original survey, or have been obliterated, what steps are necessary to have such lines surveyed and permanently marked on the ground?

4. In cases where concession lines were not run in the original survey, or have been obliterated, how would you establish the depths of adjacent concessions?

5. Describe the different methods of running a line between lots in a single front concession.

6. What is a double-front concession? and how are posts to be replaced where lost, and lines between lots therein to be run?

7. Describe the sectional system of survey and the different methods of running lot lines in that system.

8. How would you establish a side-line between lots in townships where the side-lines only were run in original survey?

9. In a single-front concession, lots 37 to 40, adjoining west boundary, are broken in front by a lake and no posts were planted in the original survey to regulate the widths of these lots. How would you run the side-lines of these lots?

10. In what case would you run a side-line between lots on the astronomical course given on the original plan and field-notes?

Group No. 10—Mining and Other Acts.

Max. Marks 100, Min. Marks 35.

RE MINING ACT.

1. Define Mining Location.

(*a*) When a mining location, in the unsurveyed territory within the districts of Algoma, Thunder Bay and Rainy River, and that part of the district of Nipissing which lies North of the French River, Lake Nipissing, and the River Mattawa, borders upon a lake or river, what reservation is made by the Crown?

(*b*) Which is the front of the location?

(*c*) What direction and length shall its other outlines be?

(*d*) What shall be its area?

(*e*) In what cases may the Commissoner of Crown Lands direct that the reservation referred to in (*a*) shall not be made?

RE REGISTRY ACT.

2. When any land is surveyed and subdivided for the purpose of being sold or conveyed in lots, by reference to a plan which has not been already registered—

(*a*) Who shall file with the registrar the plan?

(*b*) In what time?

(*c*) On what scale shall the plan be?

(*d*) How shall the plan be mounted?

(*e*) Who shall sign the plan, and how shall it be certified? Give certificate.

RE DITCHES AND WATERCOURSES ACT.

3. Give limit of work that may be carried out under this Act and what lands are liable for the construction of a ditch under this Act.

4. Under this Act how do you proceed to enforce maintenance? Who may ask for such maintenance?

5. After the Clerk receives the requisition, up to the time of his notifying the interested parties of the filing of the Award, state the duties of both Engineer and Clerk.

RE DRAINAGE ACT.

6 Under what heads shall the Engineer, in his report, make his assessment? Distinguish between the heads, and give form of schedule for assessment.

7. Define Construction, Maintenance, Sufficient Outlet, Initiating Municipality, Owner.

8. Write out short report for drainage work, having due regard to the arrangement of the various heads of which the report is made up.

9. What shall the Engineer's estimate of the work include?

SUBJECT NO. 11—LEVELLING.

Max. Marks 50, Min. Marks 35.

1. Define, Level line, Horizontal line, Levelling. Is it usual in ordinary levelling to make corrections for curvature and refraction? Give reasons,

2. Name some of the different methods of levelling with the instruments used in each case. For what purpose is each particularly adapted?

3 Describe the "Dumpy level" and show how to adjust it.

4. How would you determine whether the rod is being held vertical or not by the rodman?

5. Why is it best to take foresights and backsights of equal length?

6. Give the method of procedure in levelling a certain distance for sections, with form of Field Book and method of keeping notes.

GROUP NO. 12—PRINCIPLES OF EVIDENCE AND DRAWING UP OF AFFIDAVITS.

Max. Marks 80, Min. Marks 35.

1. What is evidence?

2. State what you consider would be good evidence.

3. Distinguish between hearsay, traditional, circumstantial and direct evidence.

4. Under what circumstances would you attach value to a person's evidence for or against his own interest?

5. Prepare a good affidavit to establish an original corner over 80 years old, giving the several steps of proof?

6. Prepare an improper affidavit, pointing out the defects therein.

Group No. 13.

(Vivá voce, and specimens)

Group No. 14—Geology and Mineralogy.

Max. Marks 75, Min. Marks 25.

1. Explain, by diagram or otherwise, the following terms: conformable, unconformable, fault, fold, strike, dip, vein, anticlinal, synclinal, outcrop, country rock and gangue.

2. Name three of the principal geological agencies engaged in the shaping of the earth's surface and describe the principal points of each.

3. In which rocks are the most valuable ores found in Ontario?

4. Into what three great classes are rocks divided? Give a short description of each class.

5. Describe the formation of coal-beds. Where are the principal coal-fields in the Dominion of Canada situate? Name the classes of coal found in these fields What are the names of the different varieties of coal?

6. Name and describe two of the great limestone formations of Ontario. Give the relative position of each as to other formations.

7. How are the various mountain ranges supposed to have been formed on the earth?

8. Describe two causes in the formation of valleys.

9. Explain the economic values of the rocks in the following formations: Hudson river, Salina and Carboniferous.

10. Name, and fully describe, six characters by which minerals are distinguished from one another, with example of each.

11. How may carbonates and silicates be distinguished by the use of the blow-pipe?

12. Make a diagram showing the structure of oxidizing and reducing flames and state which they are.

13. Name the minerals composing the scale of hardness, and explain how the scale is used.

14. Explain the commercial uses of the following minerals and give the general composition of 6 of them: graphite, hematite, halite, calcite, malachite, gypsum, barite, apatite, limonite, asbestos, anthracite, muscovite, dolomite, galena, cerussite.

15. Give an account of petroleum; how it originated; under what condition it now exists and with what it is associated. How is petroleum obtained?

16. To which classes of minerals do the most abundant ores of iron belong, or name the minerals.

17. Distinguish the following: (*a*) granite from gneiss, (*b*) galena from graphite, (*c*) native gold from copper pyrites, (*d*) granite from pegmatite, (*e*) common limestone from marble

18. Give a method of determining each of the following metals in the ore: iron, copper, lead, sulphur, mercury, aluminium.

19. Explain the differences between quick-lime, hydraulic lime, and Portland cement.

FORMS OF CERTIFICATE.

[Form A] **CERTIFICATE OF SERVICE (Ordinary Term).**

I, ..., a Land Surveyor
(Name of Surveyor.)
for Ontario, duly admitted and practising therein as such, hereby certify that
.... has served regularly and faithfully as an
(Name of pupil.)
apprentice with me, under written articles, duly executed before two witnesses, and filed with the Secretary of the Board of Examiners, for the term of three successive years, being from the .... day of ....
189.., to the .... day of ...., 189..

Dated at .... Ontario,
this .... day of ......, 189.. ....
Ontario Land Surveyor.

[Form B] **CERTIFICATE OF SERVICE (Shortened Term).**

I, ..., a practising Land Surveyor for
(Name of Surveyor.)
Ontario, hereby certify that ...., a graduate
(Name of pupil.)
of ...., has served as an apprentice with me, under articles duly filed, as required by section 17 of chapter 152, Revised Statutes of Ontario (1887), during twelve successive months of actual practice, being from the .... day of ...., 189.., to the
.... day of ...., 189..

Dated at ...., Ontario,
this .... day of ...., 189.. ....
Ontario Land Surveyor.

NEW BY-LAWS.

By-law No. 40. "The following Surveyors, having duly registered, and having proved to the satisfaction of the Council that they had been respectively in actual practice as duly authorized and qualified Land Surveyors for Ontario for a period of not less than 35 years prior to July 1st, 1892, are hereby placed on the list of Registered Surveyors for Ontario, and are exempt from the payment of further dues under the authority of sub-section 4 of section 10, chapter 34, Ontario Statutes, 1892, viz.: Tom S. Rubidge and James A. Gibson." Passed by the Council of Management 6th November, 1894. Ratified by the Association at annual meeting, 27th February, 1895.

By-law No. 41. "To provide for the exemption of certain surveyors from the operations of the 'Act to Incorporate the Association of Ontario Land Surveyors.'

"Whereas, under section 10, sub-section 4, the Association may exempt from the operations of the Act any Surveyor who has been in the actual practice of his profession for a period of thirty-five years or more as a duly qualified Surveyor: and whereas Charles J. Wheelock, Thomas Weatherald, Michael Deane, John Smith Brown, and William Edward Yarnold have represented to the Council that they had been in practice as aforesaid for a period of not less than thirty-five years previous to the date of the assenting to of the said Act, viz., 14th April, 1892: be it resolved that the said Surveyors be and are hereby exempted under the said Act." Passed by the Council of Management, 4th April, 1895.

By-law No. 42. "To provide for the exemption of Alexander Davidson from the operations of the 'Act to Incorporate the Association of Ontario Land Surveyors.'

"Whereas, under section 10, sub-section 4, of the said Act, the Association may exempt from the operations of the Act any Surveyor who has been in the actual practice of his profession for a period of thirty-five years or more as a duly qualified Surveyor: and whereas Alexander Davidson has requested that he be exempted as aforesaid in consequence of physical disability; be it resolved that the said Alexander Davidson be and is hereby exempted under said Act." Passed by the Council of Management, 4th April, 1895.

OBITUARY.

William Robinson.

We have this year to record the decease of one of the oldest of our members. Mr. William Robinson, O.L.S., died at his residence in London, on October 11th, 1894, after a long life of usefulness He was born at New Ross, County Wexford, Ireland, on March 27th, 1812. From his brother he got his first idea of land surveying. In 1836 Mr. Robinson came to Canada with his father, mother, three brothers and one sister and located at Burford, but in the following spring he went to Hamilton, where he found employment as a carpenter, of which calling he had previously acquired theoretical and some practical knowledge. From Hamilton he went to Brantford, and, after eighteen months' further experience, he proceeded, in the spring of 1839, to London, where he spent two years, and located in Toronto at the end of that period. Here, while in the service of the late Thomas Young, architect of King's College, also City Engineer and Drawing Master for the College, Mr. Robinson took a course of private study in land surveying and architecture. After leaving Mr. Young he purposed going to New York, but, having received a good offer of employment from Mr. Ritchie, one of the most prominent builders of the time in Toronto, he availed himself of it and remained for two years in Mr. Ritchie's employ, adding to his other duties that of instructing the workmen in geometrical drawing and the various practical problems connected with their work.

At the end of this time he again resumed the study of land surveying, receiving his commission at Montreal in May, 1846, with the Hon. William Henry Boulton and Hon. W. Robinson as his sureties. Returning to Toronto, the following winter was spent by him in teaching geometrical drawing to the workmen, and in the spring of that year he accepted the position of Superintendent of Buildings.

In April, 1849, he commenced a survey of the Toronto and Owen Sound Road diagonally through the Townships of Melancthon, Artemesia, Hill, etc., and completed the work (embracing about 200,000 acres) by the middle of December.

After his return he, in company with Mr. C. Rankin, conducted a business in Toronto for two years, when Mr. Rankin removed to Owen Sound, and the business was carried on by Mr. Robinson until 1852. Owing to ill health, he then returned to his father s at Burford, but shortly afterwards entered a partnership with Mr. W. B. Leather, an English engineer, and together they conducted a practice in London (Canada) for four years, at the end of which time Mr. Robinson again opened an office for himself.

In May, 1857, he was appointed City Engineer for London and held the office for more than 21 years, until the completion of the water-works, in 1878, when he resigned, with the request that his then partner, Mr. T. H. Tracey, be appointed to the position. He then paid visits to Europe and New York and returned to London, where he resided up to the time of his death. From his estate of $30,000, he bequeathed liberal legacies to all the benevolent societies in the city in which so many years of his life had been spent. He was a gentleman of rare skill and attainments, and was universally respected.

The famous water-works of the Forest City, constructed from plans prepared by himself, will be a standing monument to his memory.

THOMAS WILLIAM WALSH.

Since the date of our annual meeting the grim reaper has claimed another member of the Association in the person of Thomas William Walsh, who died at his residence, John street, Simcoe, on 14th March, 1895, in the 76th year of his age. His father was Francis Leigh Walsh, who held the position of Registrar of Deeds for Norfolk County from the beginning of the century up to a period little more than ten years ago. Thomas Walsh, the grandfather of Mr. T. W. Walsh, was a U. E. Loyalist, and one of the first two settlers in what is now Norfolk County. He also was a Land Surveyor, and the name has thus been prominent in the profession ever since that portion of Canada took its place in history.

Born in the Township of Charlotteville, in Norfolk, in May, 1819, the subject of this notice was a life-long resident of that county. He received his commission as a Land Surveyor on 25th April, 1842, and continued to exercise the duties of that calling for more than 52 years.

In 1858 Mr. Walsh was a candidate for political honors, but was unsuccessful, being defeated by Walker Powell, now Adjutant-General of Canada.

Since that date Mr. Walsh filled honorable municipal positions in Simcoe, and was for two years Warden of the county. In 1855 he received his appointment as County Treasurer, and up to the time of his death continued to occupy that office with efficiency. Upon the establishment of the Association of Ontario Land Surveyors Mr. Walsh became enrolled as a member, and was placed on the honorary list of exempted members on 4th April, 1894.

His widow, a son, daughter and three orphaned grandchildren survive him.

LIST OF MEMBERS.

The names of those members granted exemption by By-laws ratified by the Association are marked*.
The names of those granted exemption by By-laws passed by Council since the annual meeting are marked+

NAME.	RESIDENCE, P.O. ADDRESS.
Abrey, George Brockitt	Toronto Junction. D.L.S., Town Engineer.
Allan, John Richard	Renfrew. Grad. S.P.S.
Aylsworth, Charles Fraser, Sr.	Madoc. D.L.S.
Aylsworth, Charles Fraser, Jr.	Madoc.
Aylsworth, John Sidney	Selby, P. O. Box 23. D.L.S.
Aylsworth, William Robert	Belleville, P.O. Box 2. D.L.S.
Baird, Alexander	Leamington. D.L.S.
Barrow, Ernest George	Hamilton. D.L.S., M.C.S.C.E.
Bazett, Edward	Burk's Falls. D.L.S.
Beatty, David	Parry Sound. D.L.S.
Beatty, Herbert John	Pembroke. Grad. S.P.S.
Beatty, Walter	Delta. D.L.S.
Bell, Andrew	Almonte. D.L.S.
Bell, James Anthony	St. Thomas. D.L.S., Co. Engineer, Elgin.
Bigger, Charles Albert	Ottawa, 68 Daly Ave.
Bolger, Francis	Lindsay. D.L.S.
Bolger, Thomas Oliver	Kingston. D.L S., City Engineer.
Bolton, Jesse Nunn	Toronto, 264 Major st. D.L.S.
Bolton, Lewis	Listowel. D.L.S.

NAME.	RESIDENCE, P.O. ADDRESS.
Booth, Charles Edward Stuart	Kingston, 196 Colborne st.
Bowman, Clemens Dersteine	West Montrose.
Bowman, Herbert Joseph	Berlin. Grad. S.P.S., Town Engineer.
Bray, Edgar	Oakville. D.L.S.
Bray, Harry Freeman	Oakville.
Bray Samuel	Ottawa, Dept of Ind'n Affairs. D.L.S.
Brown, David Rose	Cornwall. D.L.S.
†Brown, John Smith	Kemptville. D.L S.
Browne, Harry John	Toronto, 17 Toronto st. D.L.S., C.E.
Browne, William Albert	Toronto, 17 Toronto st.
Burke, William Robert	Ingersoll. D.L.S.
Burt, Frederick Percy	New York, N. Y. Manager and Treasurer Eng. News Pub. Co., Tribune Building.
Butler, Matthew Joseph	Napanee, P O Box 359 M.I.C.E., M.A.S.C.E., M.C.S.C.E., C.E.
Caddy, Cyprian Francis	Campbellford. D.L.S.
*Caddy, Edward C	Cobourg. D.L.S.
Caddy, John St. Vincent	Ottawa, 559 King st. D.L.S.
Cameron, Alfred John	Peterborough.
Campbell, Archibald William	St. Thomas. City Engineer.
Carre, Henry	Belleville, P.O. Box 203. City Engineer, B.A. and C.E. (Trin. Coll., Dublin), D.L.S.
Carroll, Cyrus	Hamilton, 6½ James st. s. M.C.S.C.E., D.L.S.
Casgrain, Joseph Philippe Bâby	Morrisburg. D.L.S., P.L.S. (Que.), C.E.
Cavana, Allan George	Orillia. D.L.S.
*Cheesman, Thomas	Mitchell. D.L.S.
Chipman, Willis	Toronto, 103 Bay st. B.A., Sc. (McGill), M.A.S.C.E., M.C.S.C.E.
Coad, Richard	Glencoe. D.L.S.

NAME.	RESIDENCE, P.O. ADDRESS.
Cozens, Joseph	Sault Ste. Marie. D.L.S.
Creswicke, Henry	Barrie. D.L.S.
*Cromwell, Joseph M. O	Perth. D.L.S.
†Davidson, Alexander	Arkona. D.L.S.
Davidson, Walter Stanley	Arkona.
Davis, Allan Ross	Napanee. B.A., Sc. (McGill).
Davis, John	Alton.
Davis, William Mahlon	Woodstock. Grad. R. M. Coll.
Deacon, Thomas Russ	Rat Portage. Grad. S.P.S., Town Engineer.
†Deane, Michael	Lindsay. D.L.S.
Deans, William James	Oshawa.
DeGurse, Joseph	Windsor, P.O. Box 167. Chief Eng., L.E. & D.R.R.
DeMorest, Richard Watson	Sudbury.
Dickson, James	Fenelon Falls. D.L.S., Ins. of Crown Land Surveys.
Dobbie, Thomas William	Tilsonburg. D.L.S.
Doupe, Joseph	Winnipeg, Man., 190 Smith st. D.L.S., P.L.S. (Man.), C.E. (McGill).
Ellis, Henry Disney	Toronto, City Hall. D.L.S., Eng. in charge of Roadways.
Esten, Henry Lionel	Toronto, 157 Bay st.
Evans, John Dunlop	Trenton. D.L.S., Chief Eng., Cent. Ont. Ry.
Fair, John	Brantford.
Fairbairn, Richard Purdom	Toronto, 127 Major st. Surveyor for Dept. of Pub. Works.
Fairchild, Charles Court	Simcoe. Grad. S.P.S.
Farncomb, Alfred Ernest	London, 213 Dundas st.
Farncomb, Frederick William	London, 213 Dundas st.
Fawcett, Thomas	Ottawa, Dept. of Interior. Dom. Topographical Surveyor

NAME.	RESIDENCE, P.O. ADDRESS.
Fitton, Charles Edward D.L.S.	Orillia.
Fitzgerald, James William D.L.S.	Peterborough, Box 333.
Flater, Frederick William	Chatham.
Foster, Frederick Lucas D.L.S.	Toronto, 157 Bay st.
Francis, John James D.L.S.	Sarnia, P.O. Box 304.
*Fraser, Charles D.L.S.	Wallaceburg.
Galbraith William D.L.S.	Bracebridge.
Gamble, Killaly D.L.S., P.L.S. (Man.)	Toronto, 193 Bloor st. e.
Gardiner, Edward D.L.S.	St. Catharines.
Gaviller, Maurice C.E. (McGill), D.L.S.	Collingwood, Box 773.
Gibbons, James	Renfrew.
Gibson, Harold Holmes	Willowdale.
*Gibson, James Alexander D.L.S.	Oshawa.
Gibson, Peter Silas C.E., M.S. (Mich. Univ.), D.L.S., Engineer Tp. of York.	Willowdale.
Graydon, Aquila Ormsby City Engineer.	London.
Griffin, Albert Dyke	Woodstock, P.O. Box 612.
Hanning, Clement George D.L.S., C.E., (Trin. Coll., Dublin).	Preston.
Hart, Milner D.L.S.	Toronto, 103 Bay st.
Harvey, Thomas Alexander	London, 1 Oxford st
Henderson, Eder Eli	Henderson P.O., Maine.
Henry Frederick	London, Albion Building.
*Hermon, Royal Wilkinson D.L.S.	Rednersville.
Hewson, Thomas Ringwood D.L.S.	Hamilton, 42 James st. n.
Hobson, Joseph D.L.S., Chief Eng. G.T.R.	Hamilton, G. T. Ry. Office.
Hopkins, Marshall Willard B.A., Sc. (McGill), A.M.C.S.C.E.	Hamilton, 28 James st. s.

NAME.	RESIDENCE, P.O. ADDRESS.
Howitt, Alfred D.L.S.	Gourock.
Hutcheon, James Grad. S.P.S.	Guelph.
Innes, William Livingstone C.E. (Toronto Univ.)	Peterborough, 372½ Water st.
James, Darrell Denman B.A., Grad. S.P.S.	Toronto, 72 Victoria st.
James, Silas D.L.S.	Toronto, 72 Victoria st.
Johnson, Robert Thornton	Orangeville.
Jones, Charles Albert D.L.S.	Petrolea.
Jones, John Henry D.L.S.	Sarnia.
Jones, Thomas Henry City Engineer, B.A.Sc. (McGill).	Brantford.
*Keefer, Thomas Coltrin D.L.S., C.E.	Ottawa.
Kennedy, James Henry C.E., (Tor. Univ.), M.C.S.C.E.	St. Thomas, P.O. Box 434.
Kippax, Hargreaves Assistant Surveyor General.	Huron, South Dakota.
*Kirk, Joseph D.L.S.	Stratford, P.O. Box 373.
Kirkpatrick, George Brownly Director of Surveys, D.L.S.	Toronto, Dept. of Crown Lands.
Klotz, Otto Julius C.E. (Mich. Univ.), Dom. Topographical Surveyor.	Ottawa, 437 Albert st.
Laird, James Steward D.L.S.	Essex.
Laird, Robert Grad. S.P.S.	Toronto, City Engineer's office.
Lane, Andrew Grad. S.P.S., Draughtsman Maryland Steel Co.	Sparrow's Point, Md.
Lewis, John Bower D.L.S.	Ottawa, Brunswick House.

NAME.	RESIDENCE, P.O. ADDRESS.	
Lougheed, Aaron	Port Arthur.	D.L.S.
*Low, Nathaniel E.	Wiarton.	D.L.S.
Lumsden, Hugh David	Toronto, 63 Homewood ave.	D.L.S., M.I.C.E., M.C.S.C.E.
*Lynch-Staunton, Francis H.	Hamilton.	D.L.S.
Macdougall, Allan Hay	Port Arthur.	D.L.S.
MacKenzie, William Lyon	Galt.	
MacNabb, John Chisholm	Chatham.	C.E.
MacPherson, Duncan	Montreal.	Eng. Dept. C.P.Ry.
McAree, John	Toronto.	Dom. Topographical Surveyor, B.A.Sc., Toronto.
*McCallum, James	Fort Frances.	D.L.S.
McCulloch, Andrew Lake	Galt.	Grad. S.P.S., A.M.C.S.C.E.
McDonell, Augustine	Chatham, 4 & 5 Ebert's Block.	D.L.S.
McDowall, Robert	Owen Sound.	Town Engineer, Grad. S.P.S.
McEvoy, Henry Robinson	St. Mary's.	D.L.S.
McFarlen, George Walter	Toronto, Court House.	Grad. S.P.S.
McGeorge, William Graham	Chatham, 5 Sandwich st. w.	D.L.S.
McGrandle, Hugh	Huntsville.	
McKay, Owen	Windsor, P.O. Box 167.	Grad. S.P.S.
McKenna, John Joseph	Dublin.	
McLatchie, John	Ottawa, 28 Stanley ave.	D.L.S., P.L.S. (Que. & Man.)
McLean, James Keachie	Elora.	D.L.S.

NAME.	RESIDENCE, P.O. ADDRESS.
McLennan, Murdoch John B.A., Sc. (McGill).	Williamstown.
McLennan, Roderick D.L.S.	Toronto, 115 Avenue rd.
McMullen, William Ernest	Toronto, 7 Murray st.
McNab, John Duncan	Owen Sound.
McPhillips, George D.L.S.	Windsor, P.O. Box 556.
Malcolm, Sherman D.L.S.	Blenheim.
Manigault, William Mazyck D.L.S.	Strathroy, P.O. Box 300.
Marshall, James D.L.S.	Holyrood.
Miles, Charles Falconer D.L.S.	Toronto, 343 Huron st.
Moore, John Mackenzie	London, Albion Building.
Moore, John Harrison	Smith's Falls.
Moore, Thomas Alexander	London South.
Morris, James Lewis D.L.S., C.E., (Toronto Univ.)	Pembroke.
Mountain, George Alphonse M.C.S.C.E., D.L.S., P.L.S., (Que.)	Ottawa.
Munro, John Vicar	London, Albion Building.
Murdoch, William D.L.S.	Rat Portage.
Murphy, Charles Joseph	Toronto, 157 Bay st.
Newman, William Grad. S.P.S.	Windsor, 57 Sandwich st.
Niven, Alexander D.L.S.	Haliburton.
Ogilvie, John Henry D.L.S.	West Superior, Wis., 1810½ Tower av.
Ogilvie, William D.L.S.	Juneau, Alaska, U.S.

NAME.	RESIDENCE, P.O. ADDRESS.
O'Hara, Walter Francis D.L.S	Chatham.
Paterson, James Allison C.E.	Toronto, 23 Adelaide st. e.
Patten, Thaddeus James	Little Current.
Pedder, James Robert Grad. S.P.S.	Doon.
Pinhey, Charles Herbert Grad. S.P.S., A.M.C.S.C.E.	Coteau Landing, P.Q.
Proudfoot, Hume Blake D.L.S., C.E. (Toronto Univ.)	Toronto, 33 Tranby ave.
Purvis, Frank D.L.S.	Eganville.
Rainboth, Edward J D.L.S.	Ottawa.
Rainboth, George Charles D.L.S., P.L.S. Que.	Aylmer, Que.
Reilly, William Robinson D.L.S., P.L.S. Man.	Regina, Assa.
Ritchie, Nelson Thomas	Kincardine.
Roberts, Vaughan Maurice	New York, N.Y., 137 Broadway.
Robertson, James Grad. S.P.S.	Glencoe.
Roger, John	Mitchell.
Rombough, W. R D.L.S.	Durham.
Rorke, Louis Valentine	Sudbury.
Ross, George B.A., Sc. (McGill).	Welland.
*Rubidge, Tom S D.L.S., Asst. Eng. Dept. Rys. and Canals.	Cornwall.
Russell, Alexander Lord D.L.S.	Port Arthur.
Sankey, Villiers D.L.S., City Surveyor.	Toronto, City Hall.
Saunders, Bryce Johnston Town Engineer, B.A., Sc. (McGill), D.L.S.	Brockville, P.O. Box 114.

NAME.	RESIDENCE, P.O. ADDRESS.
Scane, Thomas D.L.S,	Ridgetown.
*Schofield, Milton C D.L.S.	Guelph.
Seager, Edmund D.L.S.	Fort Frances.
Selby, Henry Walter D.L.S.	Toronto Junction.
Sewell, Henry DeQuincey D.L.S., A.M.I.C.E.	Port Arthur.
Sing, Josiah Gershom D.L.S.	Meaford.
Smith, George	Woodville.
Smith, Henry Supt. Colonization Roads, D.L.S., M.C.S.C.E.	Toronto, Crown Lands Dept.
Speight, Thomas Bailey D.L.S.	Toronto, Yonge St. Arcade.
Steele, Edward Charles	Goderich.
Stewart, Elihu D.L.S.	Collingwood.
Stewart, John D.L.S.	Montreal.
Stewart, Walter Edgar	Aylmer.
*Strange, Henry D.L.S., C.E.	Rockwood.
Tiernan, Joseph Martin	Tilbury Centre.
Traynor, Isaac D.L.S.	Dundalk.
Turnbull, Thomas D.L.S., C.E., (Toronto Univ.)	Winnipeg, Man., C.P.R. Office.
Tyrrell, James Williams Co. Eng. for Wentworth, C.E., D.L.S.	Hamilton, 42 James st. n.
Unwin, Charles D.L.S.	Toronto, 157 Bay st.
Ure, Frederick John C.E.	Woodstock.

NAME.	RESIDENCE, P.O. ADDRESS.
VanBuskirk, William Fraser Grad. R.M. Coll.	Stratford.
VanNostrand, Arthur J D.L.S.	Toronto, Yonge St Arcade.
Wadsworth, Vernon Bayley D.L.S.	Toronto, 103 Bay st.
Walker, Alfred Paverley A.M.C.S.C.E.	Toronto, C.P.Ry , Eng. Office.
Wallace, Charles Hugh	Hamilton.
Warren, James Depy. Registrar County of Bruce, A.M.C.S.C.E.	Walkerton.
Watson, John McCormack	Orillia, P.O. Box 224.
†Weatherald, Thomas D.L.S., C.E.	Goderich, P.O. Box 273.
†Wheelock, Charles J D.L.S.	Orangeville.
Wheelock, Charles Richard Treasurer County of Dufferin.	Orangeville.
Whitson, James Francis	Toronto, Crown Lands Dept.
Wicksteed, Henry King D.L.S., C.E.	Cobourg.
Wiggins, Thomas Henry Grad. S.P.S.	Brockville.
Wilde, John Absalom	Sault Ste. Marie.
Wilkie, Edward Thomson D.L.S.	Carleton Place.
Wilkins, Frederick William Dom. Topographical Surveyor	Ottawa, Dept. of Interior.
Williams, David D.L.S.	Kingston.
Winter, Henry D.L.S., C.E.	Thornyhurst.
*Wood, Henry O D.L.S.	Billing's Bridge.
Yarnold, William Edward D.L.S.	Port Perry, P.O. Box 44.

REGISTERED AND WITHDRAWN.

The [illegible] of those who have become "Associates" under By-laws No. [illegible] are marked *.

NAME.	RESIDENCE, P.O. AEDRESS.
Apsey, John Fletcher Grad. S.P.S.	Baltimore, Md., 2125 N. Chas. st.
Blake, Frank Lever D.L.S.	Toronto, Meteorological Office.
Bowman, Franklin Meyer Grad. S.P.S.	Berlin.
Burnet, Hugh P.L.S. (B.C.).	Victoria, B.C.
Cambie, Henry John P.L.S. (B.C.).	Vancouver, B.C.
Coleman, Richard Herbert	Toronto, 204 King st. e.
Drewry, William Stewart	Ottawa, Dept. of Interior.
Ducker, William A D.L.S.	Winnipeg, M., 314 McWilliam st.
Edwards, George	Thurso, Que.
Fowlie, Albert D.L.S.	Orillia.
Green, Thomas Daniel	Ottawa, Dept. of Indian Affairs.
Galbraith, John Prof. Engineering.	Toronto, Sch. of Prac. Science.
Gibson, George D.L.S.	St. Catharines.
Haskins, William M.I.C.E., D.L.S.	Hamilton, 45 Wellington st. s.
*Harris, John Walter P.L.S. (Man)., D.L.S.	Winnipeg, Assm't. Com. Dept.
Hermon, Ernest Bolton P.L.S. (B.C. , D.L.S.	Vancouver, B.C.

NAME.	RESIDENCE, P.O. ADDRESS.
Irwin, James M D.L.S.	Peterborough.
Jephson, Richard Jermy P.L.S. (B.C.) D.L.S.	Calgary, Alta.
Kains, Tom Surveyor-General, B.C.	Victoria, B.C.
Lendrum, Robt. Watt D.L.S.	South Edmonton, Alta.
Livingstone, Thomas Chisholm D.L.S.	Winnipeg, Man.
MacLeod, Henry Augustus F C.E., D.L.S.	Ottawa, 340 Cooper st.
MacMillan, James A P.L.S. (B.C.).	Calgary, Alta.
*McFadden, Moses D.L.S.	Neepawa, Man.
Magrath, Charles Alexander B.A. Sc. (McGill), D.L.S.	Lethbridge, Alta.
Morris, Alfred Edmund	Perth.
Pearce, William Dom. Insp. of Mines.	Calgary, Alta.
Ponton, Archibald William D.L.S.	Regina, Assa.
Pope, Robert Tyndall C.E., D.L.S.	Ireland.
Reid, James Hales C.E., F.G.S.	Bowmanville, Box 35.
Reiffenstein James H D.L.S.	Ottawa, Dept. of Interior.
Rogers, Richard Birdsall B. A. Sc. (McGill), D.L.S.	Peterborough.
Ross, Joseph Edmund P.L.S. (B.C.).	New Westminster, B.C.

NAME.	RESIDENCE, P.O. ADDRESS.
Sanderson, Daniel Leavens	Coral, Mich.
Strathern, John P.L.S. (B.C.), D.L.S.	Vancouver, B.C.
Sherman, Ruyter Stinson P.L.S. (B.C.).	Vancouver, B.C.
*Silvester, George Ernest Grad. S.P.S.	Pittsburgh, Pa., Shiffler Bridge Co.
Simpson, George Albert C.E., D.L.S.	Winnipeg, Man., N. P. & M. R'y.
Spry, William C.E., D.L.S.	Toronto.
Stewart, Louis Beaufort Lect. in Surveying.	Toronto, Sch. of Prac. Science.
Thomson, Augustus Clifford C.E., D.L.S.	Kansas City, Mo.
Tracey, Thomas H P.L.S. (B.C.), C.E., D.L.S.	Vancouver, B.C.
Vicars, John Richard Odlum P.L.S. (B.C.), D.L.S.	Kamloops, B.C.
Weekes, Abel Seneca D.L.S.	Wetaskiwin, Alta.
Wheeler, Arthur Oliver P.L.S. (B.C.), D.L.S.	New Westminster, B.C.
Willson, Alfred D.L.S., Comm. Can. Co.	Toronto, 204 King st. e.

SUMMARY.

Active members subject to dues	195
Active members exempted from dues	21
Withdrawn from practice (including Associates)	45
Dead	4
Total number enrolled since incorporation	265

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Ernest . . . . .
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